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AN ATTEMPT TO DETERMINE THE PERIODS, IN ENGLAND,
WHEN FIR, DEAL, AND HOUSE PAINTING WERE FIRST INTRODUCED;
WITH REMARKS ON THE PROCESSES OF THE LATTER.

By WYATT PATWORTH, Esq., Architect.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, November 2, 1857.

It has been supposed that the timber seen in old buildings is almost generally oak; but it will be found on investigation, that many other kinds of wood were used, a knowledge of which, tested as they have thus been in trying positions, would be highly serviceable to the architect and to the builder. From records quoted in Mr. Turner's "Domestic Architecture of England,"* it appears that in 1253, temp. Henry III., the bailiffs of Southampton were commanded to buy two hundred Norway boards of fir to be used at Winchester for wainscot; that in 1255 one thousand Norway boards were purchased for wainscoting certain rooms in Windsor Castle, and that a house of deal was to be made, running on six wheels and roofed with lead. The word used, "*sapo*" or "*sappo*," has been translated "deal;" this latter is stated to be derived from the Dutch, *deelen*, or German, *dielen*, "firwood," which would perhaps be the better translation of the word "*sapo*."† Turner gives his opinion that "the wood ordinarily used was fir, possibly because it was cheaper and more easily worked than oak," and that "Norway planks were largely imported into this country from an early period of the 13th century, and perhaps, although it is not quite so clear, at a still earlier time." His authority for these remarks appears to me very slight; but he has in his favour the fact that treaties "for the benefit of trade" were made by Henry III. with one or two of the kings of Norway; the use of the timber however would appear (from those records) to have been confined to the Royal works. Deal boards bought for doors and windows, are mentioned between 1272 and 1307. One of the halls appropriated for the royal seat at the coronation of Edward II. (1307), was therefore ordered to be covered with boards "*de sapo*." The wardrobe accounts of Edward IV. (1480), mention "*cofyns of fyrr*" for the carriage of the king's books to Eltham.

The above extracts show that fir timber was imported at that early period; and omitting the last record, we must now pass over an interval of about two hundred years to the next date. The first statement I have been able to find of the actual importation of timber is as late as 1517, temp. Henry VIII., when the Dutch in particular were accused of bringing over iron, timber, and leather, ready manufactured. During that monarch's reign the scarcity of timber began to be experienced, and several statutes were passed for fixing the price of barrels, requiring the importation of clapboards for their manufacture; and for the preservation of the forests of England, but excluding the counties where iron works had been carried on from very ancient times. Queen Elizabeth (1558-1603) having reduced the forests still further, passed subsequent acts for their future preservation. Mr. Clayton, in his work on the ancient timber edifices of the western part of England, states that the timber buildings (of this period, that of the 16th century) were invariably constructed of oak, of extreme durability; and the often quoted writer Harrison (1573), in the reign of Elizabeth, says, "the wals of our houses on the inner sides be either hanged with tapestrie, arras worke or painted cloths—or els they are seeled with oke of our owne, or wainscot brought hither out of the East

* The omission in this work of information as to the exact kind of wood used in the different buildings referred to, is the more to be regretted, as the author of the second volume states that he had visited every place he describes.

† French, *Sapin*.

countries;" and in another place, "in times past, men were contented to dwell in houses buylded of willow, willow, plum tree, hard beame, and elme, so that the use of oake was in a manner dedicated unto churches, religious houses, princes' palaces, noblemen's lodgings and navigation; but now all these are rejected and nothing but oke anie whit regarded." It will be observed that fir is not mentioned. During the last years of Elizabeth's reign, cottages and farmers' houses were building in all directions, and in London the progress of building was likened to an inundation. Large quantities of timber were thus needed, as brick had not yet been adopted for general use.

Although without any historical record of the fact, it is to about this period (1558-1603), and to the above-named causes, that I should attribute the general introduction of foreign timber as an article of commerce; in 1553 (1st of Mary) the English discovered Archangel, and in 1560 commenced trading to Narva, then belonging to Sweden. The fitness of fir and other woods for building, is set forth by an English writer in 1586, seventeen years before the death of Elizabeth:—
 "Fir timber is meet for divers workes, and greatly esteemed for his height and bignesse, whereof are made the ship masts and pillars for houses, for it is very strong and able to abide great force. It is used also in building, for great gates and door posts; in fine, good for any building within, but not so well enduring without doores, and very soone set a fire.—The firre, the poplar, the ash, and the elme are meet for the inner parts of the house, but they serve not so well in the weather as the oke doth. The best to bear weight is the fir and the larch, which howsoever you lay them will neither bend nor break, and never faile till wormes consume them.—Ash for thin borde; the best to clean, the firre, the poplar and the beech." In or about 1603 Sir Walter Raleigh presented to James I. some observations on trade and commerce, showing how the Dutch had engrossed the transport of the produce of other countries, and stating that "the exceeding groves of woods are in the East Kingdoms, but the huge piles of wainscot, clapboard, fir, deal, masts and timber, is in the Low Countreies where none grow, wherewith they serve themselves and other parts, and this kingdom, with those commodities." From other accounts it appears that for about seventy years a very considerable trade had been carried on with Russia—(Archangel, as above stated, was discovered by the English in 1553), and that down to about the year 1590 a large number of ships sailed annually to that country; but in 1600 only four had been sent out, and in 1602 only two or three; whereas the Russian trade of the Dutch employed from thirty to forty ships each as large as two of the English, and all chiefly laden with English goods. Though the above shows the extent of the trading, yet a pamphlet, published sixty years later, in 1662, whilst describing the produce of Russia, mentions oak as the only timber exported. By the year 1688 Germany, Prussia and Norway, all sent timber and deal boards. In 1662, Charles II. interdicted the importation from the Netherlands and Germany of deal boards, fir, timber, and other articles, upon any pretence whatsoever.

Besides a panel, to which I shall refer presently, and the date whereof is somewhat uncertain, the earliest instance of the actual use of deal I have been able to find, is in the description of Wimbledon Hall, erected in 1558 by Sir Thomas Cecil. This building became about 1640 the property of Queen Henrietta Maria, and was surveyed by order of the Parliament, in 1649. The accounts do not state whether any repairs were made in the sixty years between the date of its erection and the survey. If the deal, therefore, which was introduced so largely in the floor boards and wainscoting was not in the original erection, we must infer that the house was put into repair or modernised near the middle of the 17th century, when it was prepared for the queen; I am in favour of the deal having been used in the original erection.

The survey, occupying over fifty pages of the tenth volume of the *Archæologia*, describes how each room was paved, lighted and ceiled; whether wainscoted, coloured or plastered; what fixtures

remained therein ; concluding with the state and extent of the gardens and buildings, the park, and erections belonging to the estate. The use of deal for floor boards, wainscoting, wall linings, presses, &c. frequently occurs in the account, which time will not permit me to give at length. Among the exterior buildings a pheasant garden is described, severed from the park by a pale of deal boards 10 feet high. The land of Richmond Palace is likewise described as part fenced with brick, and part with deal boards.

Another early instance may be obtained by inference, in Brandenburgh House, Hammersmith, erected about the beginning of Charles the First's reign (say 1630) by Sir Nicholas Crisp, the materials of which were sold by auction in 1822, *the dry rot* having got into the timbers. (Falkener's Hammersmith, edit. 1839.) Sir Bulstrode Whitelocks, Ambassador to Sweden in the time of Cromwell, on his return in 1654, brought a cargo of deal boards, which he mentions in his journal to have been used at Fawley Court for new flooring his hall and for wainscoting it.

Respecting the asserted practice of 'painting' during the 13th century, Turner says a few instances do occur of directions to paint the woodwork, but in a note he adds that the chapel built by Henry III. (1216-72) at Windsor, had a wooden roof formed and colored to imitate one of stone at Lichfield, and that wooden and stone posts or piers and arches were painted marble color, as were those of the halls of Guildford and Ludgershall. During this century, the ordinary custom was to decorate in paint or color the wainscoting with patterns or subjects taken from sacred or profane history. Green was the favorite color, very frequently starred with gold, with borders of a different pattern, male and female heads, &c. This wainscoting being generally only 5 or 6 feet high, the wall or plaster above it was painted in fresco or in water, to represent some history, or a curtain. The Queen's chamber at the Tower was to have the walls whitewashed and pointed, and within those pointings, painted flowers; the next year the same chamber was to be thoroughly whitened internally and newly painted with roses; also the King's own chamber was to be entirely whitewashed. But this was not confined to internal work, for in the following year the King directs that water pipes should be put up to the great tower, so that the wall of the said tower which has been newly whitewashed, might be in nowise injured by the dropping of rain water, nor be easily weakened. Even the chapel of St. Catherine in Nottingham Castle was to be whitewashed on every side and pointed lineally: directions are also given to whitewash within and without the King's chapel, the Queen's chapel and chamber, and the Queen's great wardrobe, all at Guildford, where the hall also was whitewashed. Whitewashing would appear to have been then almost a royal luxury; though not wholly so, for evidence is found that during the 13th and 14th centuries the citizens of London not only whitewashed their walls but were compelled by the magistrates to do the same to the thatch of the roofing, as a precaution against fire. White lead and oil, with fine and inferior varnishes, were also extensively employed in this period for the decorations. Turner in support of external painting states that the habitable buildings being of timber, it would require painting in some way to be preserved from the weather, for although park palings will stand for almost any length of time, yet carved woodwork, and even plain timber when mixed with plaster, require painting. He appears to have formed this opinion upon the present mode in Lancashire and Cheshire, of painting (coloring?) the timbers black and the interstices white. Clayton says "it would seem probable, from the appearance of the timbers in many of these buildings (the Town Halls of the 16th century) that their surfaces were originally protected by a description of paint, of a rich brown color; it is, however, extremely uncertain whether the practice of blackening them as usually done in the present day can be traced to ancient origin." The following extract from a record, dated 1574, will remove any doubt on the point; "the plastering and whitening the forefront of my M^r his house in Coleman Street, and the courte, with the blacking of the timber work, 42s. 6d."

The extensive employment of tapestry in the 14th and 15th centuries would appear to have allowed the whitewasher to rest, except for the ceilings which were 'white-limed' as usual; a few walls, however, were white-limed even in Elizabeth's reign, but then they were decorated with poesies and moral proverbs on fantastic labels, of which Lockingfield furnisbew so profuse an example. At Hardwick Hall, 1570, the walls of the state room are divided at about half the height by a stringing, the upper part filled with landscapes, figures and animals relieved in plaster, and painted 'all proper' on a white ground; the lower division hung with tapestry: the oak panels of the wainscot of one of the rooms are all marked in gold with the Stafford knot, the cognizance of that family. The survey already mentioned of Wimbledon Hall in 1640, states that the oak wainscot was varnished green with gold stars, crosses, &c.; or colored with 'livor color' and varnished; or varnished white filletted with green; and it consequently may be inferred from the absence of all description to the contrary, that the deal so much employed was left plain. "The 'knotte' in the garden are compassed about on three sides thereof with very handsome rails, piked with spired posts, in every corner and angle, all of wood, varnished with white, which very much adorns and set forth the garden." Oil painting is thus not noticed.

As a probable illustration of the use of deal in the reign of Elizabeth, and also of this mode of decoration, Mr. Reynolds Rowe of Cambridge has forwarded the panel of fir now on the table: it originally had a ground work of vermillion, in the centre of which was a pattern laid on in gold of a good thickness. This panel formerly belonged to Swavesey Manor House, in Cambridgeshire, temp. Elizabeth, which still contains some of the same kind of work, probably under the coat of white paint of a later period, bits of which are still to be seen on the specimen.

In connection with this period reference may be made to a small octavo volume, by Stephen Primatt, published in 1667, the year following the Fire of London, and evidently intended as a guide to builders. Describing the finishing of the various classes of houses illustrated; he specifies that the walls of each floor are to be 'plastered and sized'; the partitions to be 'lath, plaster and rendered and sized.' Painter's work is described "for a fair stone color laid in oil for windows, doors, rails and banisters for staircases, shop windows and modillions 12d. per yard, being colored over thrice. For a timber color in oil over doors and windows 9d. per yard. For a door painted on one side with a stone color 12d. a yard, and for a light of a window 6d.; for a lead color in oil 9d. or 10d. a yard. Painter's work of ordinary lights of windows in oil at 6d. per yard or 3d. per light. For painting the best cerulean or blue color in oil 1s. 6d. per yard;" this is the only expensive color mentioned, and seems to indicate the origin of a peculiar color for metal work. Whitewashing with size is given as worth 2d. per yard.

In 1671 it was agreed that the wainscot in the Hall of the Carpenters' Company should "be handsomely painted, and the walls above the wainscot on the south side hung with painted cloth of some neat painting work suitable to the front side." A French traveller in England in 1672, remarks that "the houses of Canterbury are well built and painted after the Dutch fashion." For many years after 1700 the following description from a work of the period will convey some idea of the extent of painting practised. "Out-door painting for doors, shop windows, window frames, pediments, architraves, friezes and cornices, and all other timber work exposed to the weather ought at first setting up to be primed with Spanish brown, Spanish white, and red lead (about a fifth part) to make the other two colors dry, ground in linseed oil; then again with the same color only whiter, and lastly with fair white made of white lead and about a fifth part in quantity, (not weight) of Spanish white. "Wainscot color," "white color," and "walnut color" are enumerated; also "ordinary branched painting" and "plain japan, either black or white." On considering this recital of painter's work

I have thought that these, wainscot, and walnut colors, were used for the purpose of making woodwork resemble those woods. An interesting account has lately been published of a lady of rank, who, in 1612 or 1613 appears to have entirely changed the fashion of the arrangements of houses in France, and to have been the first who painted rooms in any other color than red or tawny. The next and last item in the description is "whiting and coloring on plasterer's work." Here I would request your attention to the continued use of "color" (distemper) for interior work, down to such a late period, (1700) a fact which I conceive at once accounts for the extensive use made of it in our churches. It is clear that from about 1700, oil paint became a disquiser of materials, and we know from his own description* that the interior of St. Paul's Cathedral was painted under Sir Christopher Wren's direction. In a work of 1703, the contrivance of closets in most rooms, and painted wainscot are mentioned as two great improvements. Perhaps the first intimation of oil paint being used to a large extent *internally*, is in a "Compendium" of 1721: it states that the taking of the dimensions for painter's works within doors is the same with that of the joiner's, by girting about the mouldings and members of cornices, &c.; but the painter never requires work and half work as the joiners do, but reckons his work, once, twice or thrice primed or colored over. Wood in his history of Bath says, "about 1727 if the walls of any of the rooms were covered with wainscot it was with such as was mean and never painted,—as the new buildings advanced the rooms were all wainscoted and painted in a costly and handsome manner."

Ware, in 1767, writes that "fir, as it is cheap and works easy, since the use of paint has become so frequent, has in a manner superseded all other kinds." In the descriptions of buildings given at the end of his work, he specifies that the walls are to be rendered and floated for hangings, and paints all the wainscoted rooms a "common or stone colour" three times in oil. In 1775 a large mansion in the country is stated to have paper to the ground floor rooms, whilst the walls of the bed rooms, garrets, and basement were lime-whited. And at the beginning of the present century, says a later writer, the houses of traders and middle classes, particularly in the provinces, were chiefly adorned with simple washings of rose pink, whitening and size. A friend, now in his eighty-fifth year, remembers the lining to walls being often left unpainted, and much of the woodwork even in the rooms connected with the Houses of Parliament were also of plain deal. The plastered walls of houses were coloured, the sashes painted white, the doors, skirtings and other parts generally black. Several present can no doubt recall houses in the country still exhibiting this ancient style of ornamentation. Thus we may conclude that house painting, or as it has been very descriptively termed, the "three coats and flat" work, did not come into fashion until about the period of William and Mary and Anne, up to which time either colouring by distemper or by whitewash had been in vogue for plasterwork, leaving inside wood-work more or less untouched.

In every branch of painting in oil applicable to buildings, the general process will be found very similar, with the exception of such variations as easily suggest themselves to the careful workman. The first essential is that the wood, plaster or cement should be perfectly dry. This is acknowledged by all, and yet when despatch is the order of the day, it must be neglected. One writer goes to the extent of stating, that "perhaps in general cases, where persons are building on their own estates or for themselves, two or three *years* are not too long to suffer the stucco to remain unpainted; though now frequently in speculative works as many weeks are scarcely allowed." The wood-work having been prepared for fixing, has first to undergo the operation of "knotting," in order to prevent the turpentine in the knots of fir-wood, from passing through the several coats of paint. One method for

* See his pamphlet in answer to alleged "Frauds and Abuses at St. Paul's."

best work is to cut out the knot whilst the work is at the bench, to a slight depth, and to fill up the hole with a stiff putty made of white lead, japan and turpentine. There are many ways of "killing" the knots. The best and surest is to cover them with gold or silver leaf. Sometimes a lump of fresh slaked lime is laid on for about twenty-four hours, then scraped off, a coating of size knotting applied, and if not sufficiently killed they are coated with red and white lead in linseed oil, and rubbed down when quite dry. The general method is to cover the parts with the "size knotting," i. e. a preparation of red lead, white lead and whitening, made into a thin paste with size. The most common mode is to paint them with red ochre, which is worth nothing. The next process is that of *priming*, which consists in giving a coat of white lead with red lead, and a little drier in linseed oil. This is the first coat and upon which the look of the paint on completion depends. This first or priming coat is put on before "stopping" the work, should that process be required. It consists of filling up with putty any cracks or other imperfections on the surface of the wood. If the putty used in the process of stopping be introduced before the first coat of colour is laid on, it becomes loose when dry. A good painter after the application of this first coat, removes by pouncing all irregularities from the surface, especially those rendered apparent by the knots and fibres of the wood. A smooth surface being thus obtained, a second coat is given, consisting of white lead and oil—about one-fourth part of turpentine is sometimes added for quick work. If four coats are to be put on, this second one has sometimes a proportion of red lead, amounting to a flesh colour; but if only three, it is generally made to assume the tint of the finishing coat. It should have a good body and be laid even. This coat when thoroughly dry and hard, is in best work rubbed down with fine sand paper, and carefully examined to ascertain whether any further stopping be required; and then the third coat or "ground colour" applied, of a somewhat darker tint than wanted when finished, having sufficient oil for easy working, but not too fluid—thus two-thirds oil and one-third turpentine are employed; or sometimes equal proportions of oil and turpentine. The *flating* coat follows, the object of which is to prevent the gloss or glaze of the oil, and to obtain a flat dead appearance. The advantage is not confined to the look of the paint, for it hides all defects in the wood or other material that is painted. White lead is mixed with turpentine, to which a little copal varnish is sometimes added, and when the tint is put in it is always made lighter than the ground colour, or it would when finished appear in a series of shades and stripes. Flating must be executed quickly, and the brush is generally, if not always, carried up the wall and not across it. It must be understood that a flating coat is not considered as a coat of paint; being wholly of turpentine, it is by exposure to the air evaporated, leaving a thin coat of pigment which is only required for effect, not for use. Some painters, particularly where the work is required to dry rapidly, use a large proportion of turpentine in the several coats; thus the ground coat has two-thirds oil and one-third turpentine. If four coats are to be laid on, the third has a little more turpentine than usual, which in the second is about a quarter, and so on. I would suggest for particular attention that *turpentine* on the whole is chiefly useful for the purpose of saving oil and labour. It should never be employed where really lasting work is required. The necessity of having the substance perfectly dry before it is painted has already been noticed, and it is equally important that each coat of paint should be quite hard before another is applied, more especially where the work is exposed to the sun. When the material is quite dry the first coat is readily absorbed by the wood or plaster. Plaster to be painted requires some additional care in the workmanship itself; unless it be quite good, the lime works out in minute bubbles and destroys the effect of the paint, which can only be corrected by rubbing down and repainting, even then with no great certainty of success. Some persons advocate the use of a priming or of a second coat, made of strong double size stained with some color to mark where the brush goes. The second

coat then consists of white lead in all oil, used as stiff as possible; the third coat is made of single size with a little white lead ground in water to mark the course of the brush; and the fourth coat of white lead in two-thirds oil and one-third turpentine, with a little blue black to take off the rawness of the white. Such work as this is now generally repudiated; those in its favour state that it is of equal benefit with a coat of paint for inside, but confess that it is not so for outside work. Its objectors state that such "sheepskin" coats prevent the paint from sinking into the wood or plaster, causing the paint to peel off and chip; I fear that it is much practised in inferior work. When inside work has to be finished of any color, it becomes necessary to provide for it at the third or second operation, according to the number of coats; particularly if the work is to be finished flat, or as it is termed, dead white, grey, &c. All new *outside work* should be primed a flesh color, mixed in all linseed oil. The second coat may be of the same mixture if four coat work is to be done; and in this coat all defects are to be made good. If three coats only are to be applied this one should be laid on with care. The third and fourth coats, whichever may be determined upon, are generally white, stone color, lead color, chocolate, olive and invisible green, all in linseed oil. When white lead is employed alone, it has been recommended to dilute it with half drying or boiled oil, and half linseed oil, as the boiled oil affects the color of the white lead a little, but in all other colors boiled oil may be considered the best for the purpose of preservation. When it is required to cover a painted material, or "to repaint," the surface must be prepared to receive the coats of paint; it is sometimes first washed, or if the work be very greasy, turpentine is used, after which the paint is rubbed down with pumice stone and water, or with some potash in it, until an even surface is obtained, removing any knobs or imperfections in the previous coatings. In repainting, the first coat is called "second" coloring, the old work being considered equal to a primed state. It is composed of white lead, turpentine and oil, with the pigment required for the color that may be wanted. Some painters use two-thirds turpentine and one-third oil; others three-fourths turpentine and one-fourth oil; and even all turpentine, dryer, and a very little red lead; but this last must be worked very quick, crossed once, and laid with the grain of the wood, as it is not much better than a flattening coat. For third coloring or finish, the white lead is thinned with half turpentine and half linseed oil, dryer, and a very little blue black, to take off the rawness of the white and also to make it cover better. For the best rooms the flattening coat is required as before described. Two coats of new paint is frequently sufficient for ordinary work where painted previously. Light colored work, as margins, rails and so on, is generally painted before the darker work, as mouldings, &c. Carved work especially requires care to prevent the work being clogged up.

Where the face of old work presents a very bad and uneven appearance from hlisters or other causes, the inequalities are filled up with a cement. Modern specifications often require that the wood-work should have four or more coats until the paint "bears out." This is certainly necessary when it may be anticipated that little oil will be used, or where the priming and early coats may not have been properly attended to. The result is a deadness in one part, the glaze continuing in another. It often happens too, that the sun and air has quickly dispersed the greater part of the most valuable quality of the paint, *i. e.* its oil, and the work presents the same flatness. Care is also required when constantly painting in chocolate or black; if these are made too thin with boiled oil hlisters occur, which causes the paint to peel off and leave the wood almost bare.

Painting plaster work demands a few observations. White lead and linseed oil with some litharge as dryer, are mixed to the consistence of thin cream, and applied; the oil is entirely absorbed into the plaster in a few hours. This coat will perhaps be sufficiently dry in a day or two, when another, a little thicker, is given, the oil of which is also wholly or only partially absorbed, according to the nature of the plaster. In a few days a third coat can be applied, made rather thick, and

(according to the absorption of the oil from the second coat) one fourth or less of turpentine is added, and likewise the pigments approaching to the tint required. Should the plaster be thoroughly saturated, the flattening or finishing coat is applied as before described. When very durable work is required, a fourth coat is put on, thinned with equal proportions of turpentine and oil, and then the flattening coat. If the plaster be not flattened, the last coat is made of two parts turpentine to one of oil. By thus painting, plaster is rendered incapable of absorption, and its surface becomes hardened by the oil to a depth of about an eighth of an inch, rendering it less brittle, and enabling the surface to be washed. To effect absorption quickly, painters sometimes give the plaster two or three coats of boiling linseed oil, which are soon absorbed, and then give it the other coats of paint.

The substance generally constituting nine-tenths of the body of paint, is carbonate of lead, commonly called white lead, the quality of which is therefore of the greatest importance to the durability of the work. White lead is said to improve by being kept for several years before use. Besides the three qualities manufactured, six or more chief modes of adulteration have been recorded: 1, by carbonate of lime, as chalk, whiting, &c.; 2, sulphate of lime, as gypsum, selenite, plaster of Paris; 3, carbonate of barytes; 4, sulphate of barytes; 5, pipe and other clays; and 6, starch, flour, &c. Fine whiting ground in oil is very difficult of detection; it not only renders the paint a much less compact body, but causes it to be more easily acted upon by the atmosphere, thus blanching it and destroying it by repeated washings. These adulterations will in some measure account for the great difference that exists in the prices of painters' work. The other metallic white paint now used is zinc white, well known for its intense whiteness, its resistance to sulphurous and other deteriorating causes, and its harmless qualities to the painter and the inmates of the house under decoration. It is requisite that the oil used should be as white as possible, all the brushes and pots well cleaned with spirits if they have been used before for white lead, and driers or colours with a lead basis should not be mixed with it. Zinc white possesses less body than white lead, and great care is requisite that the colour when ground in oil is of sufficient consistence to be laid on a flat surface without showing through; for in that state any oil in excess will form a slight glutinous coating on the surface, retaining every particle of dust brought in contact with it, until it has evaporated. In general this white will not dry so quickly as the older color, but this defect is remedied by the application of proper drying oils. With these precautions a few trials will enable any painter who chooses to work zinc white to overcome the difficulties which appear at first to condemn the invention. It is asserted that in consequence of the great durability of the colour of this paint, a house painted with it may be washed for a succession of three, four, and even five years; and that after each successive washing, the surface will be found as clear and bright as when fresh painted.

Clearcole has already been referred to in conjunction with coats of oil paint. It is a cheap mode of painting, when used alone, for servants' rooms, kitchens, and such like places where despatch is necessary, or when it is necessary to paint often. The old work should be well cleaned and dried; and then a mixture of white lead, ground up in water and mixed with size, laid on: this will dry directly. For finishing, the white lead is mixed in half linseed oil and half turpentine, and used as stiff as possible; blue black, or some colour, and a little drier, are requisite.

The use of distemper is older than that of oil and varnish. Whitewashing is a kind of distemper, especially when size is used with it. The extracts from the records in the former part of this paper have no doubt reference to this kind of painting, and the word "color" would be more applicable as a translation than "paint," which is generally used. Common distemper color for walls is Spanish white, or whiting, broken into water, to which is added strong size whist warm, and then allowed to cool, when it should appear a thin jelly; two coats are generally necessary; when applied, the old work

should be first washed by a brush with water. This process in old publications is called "painting in water colors." Papered rooms colored in this manner, especially if flock papers were used, look very well, as the pattern can be seen through the coats of colour. A convenience in the use of this preparation is that the rooms may be completed and dry in one day, with very little dirt or inconvenience. It is not generally known that walls which have been distempered cannot afterwards be lime-whited, in consequence of lime when laid on whitening becoming yellow: oil colours, however, can be applied afterwards, and then white lead is used. Apartments that are to be varnished are prepared in two ways. The first is by applying the intended distemper colour, and then covering it with as many coats of coloured or uncoloured varnish as may be required. It may be useful to observe that distemper causes the wood to swell, and that if the material be not quite dry previous to the application of the varnish, the latter penetrates into the size, but is prevented from reaching the wood by the moisture retained in it, which opposes any union with the resins forming the base of the varnish. The varnish then gives to the distemper the hardness of cement, which not yielding to the shrinking of the wood, scales off in drying. The second method is to grind and mix up the colour with varnish, which produces a better result, especially if the coating be applied when the wood-work is dry, and if it be very clear so as to dispose the wood to imbibite it. The successive coats then become incorporated with the first. Generally but little colour is added to the last coat of varnish, and in some cases it may be applied colourless. It then forms glazing, and its brilliancy is greater; the colour also is stronger. The use of size produces a considerable saving of varnish, and the splendour given to this last stratum conceals the imperfections of an unequal coating of the colour. For new plaster work a coat of size is requisite; a solution of glue in water, not too strong, is applied warm that it may penetrate the plaster, which should be already quite dry. Additional effect may also be obtained by a careful pumicing after the first coat.

It is generally asserted that varnish is more liable to injury by dirt than oil paint, and that the means of repairing it cannot be the same, because the dirt adheres more strongly to the resinous parts of the varnish than to the oil surface. Soap and water applied carefully with a sponge, and the use of clean warm woollen cloths to dry the work, are efficacious means of cleaning both surfaces. The steps of wooden staircases which have been painted, grained and varnished, wear better than those which have been only painted; the gloss is only very slightly injured by the operation of cleaning, and neither dust nor dirt adhere so easily. A coat of varnish can be again put on at any time.

The processes of graining and marbling may be traced back as far at least as the time of James VI. of Scotland, (1567-1603) during whose reign a room of Hopetoun Tower was painted in imitation of marble. Before that period, imitations, as I have already mentioned, were done in stone color, marble color, wainscot color, &c. In 1676 marbling was executed, as well as imitations of olive and walnut woods; and in 1685 tortoise shell was copied on battens and mouldings. The friend above referred to, tells me that the doors of the Chapel in Conduit Street, Bond Street, attracted much attention from the novelty of their being grained to imitate wainscot, done, perhaps, about the year 1810 when a new front was given to the building. From some letters in my possession I find that mahogany was imitated in 1815, and maple wood in 1817. The imitating *marbles* and most kind of woods has nothing very peculiar in its mode of execution, being similar to actual painting, the result depending more on *natural taste* than on *mechanical skill*. The process of graining is in the first instance the same as for ordinary painted work, but it requires more care in obliterating the marks of the brush. The last coat, instead of being flatted, is composed of equal portions of oil and spirits of turpentine, and is brought up to the color characteristic of the wood to be imitated. The shades and grain are given by thin glazings of Vandyke brown, burnt sienna or umber, ground in water and

mixed with small beer, which is a sufficiently glutinous vehicle, but imitation wainscot requires a thicker one in order to receive the impression of the combs by which the grain is imitated. Thus oak graining is executed with color in turpentine mixed with a little turpentine varnish; the work being covered with it, the combing is done without delay as it dries very quickly. The lights are then taken out with a camel's hair brush, or a rag moistened with turpentine, and rubbed clean. In cheap work the operation ends here, and the surface is covered with copal varnish to protect it; but good work is 'overgrained,' that is, a glaze of color in beer, as dark as may be requisite, is laid over the combed work, in shades thrown across the work. Sometimes the whole panel is laid in with this glaze, and the lights taken out with a sponge; a brush is then used to lighten the edges: when quite dry the work is overgrained with the same color laid on thin and softened off. For graining wainscot in oil, bees wax is used instead of varnish to the color, mixed in equal quantities of turpentine and oil: one, two, or three coats of a good oil varnish, such as copal, are applied when the work is quite dry.

Time only allows me to mention the use of staining and varnishing, and to refer slightly to the process of polishing wood by varnish and wax. Varnish, and polish, both form a glazing, and give a lustre to the wood they cover, as well as heighten the colors of the wood, but from their want of consistence, they yield to any shrinking and swelling, rising in scales or cracking when much knocked about, which damages can only be repaired by application to a proper workman. Waxing, on the contrary, resists percussion, but it does not possess in the same degree as varnish the property of giving lustre to the bodies on which it is applied; any accidents, however, happening to its polish are easily repaired by rubbing. As another method of covering a surface, the board now exhibited has been prepared to show how deal may be employed without the use of oil painting. The surface having been prepared, it was at once grained, the natural colour of the wood forming the ground of the imitation wood, the whole was then varnished as usual. In coarse deal, the knots might be worked into the pattern, but in wood selected for the purpose, the small knots could hardly be said to disfigure the work. Another advantage to be considered of material importance is, that as there is no oil painting required, the material would be drying to the last minute of finishing the house, when the graining and varnishing would be done in a few days.

The proper time to paint is a subject worth consideration. For interior work it is not so important as it is for exterior; though for the former some part of the warm, not hot season, should be selected, not only to get rid of the smell more quickly, but because moderate heat improves the look of the work, while cold air chills the oil. For external work, the proper season is undoubtedly the autumn, when the days are sufficiently hot to dry the work properly, and the weather sufficiently settled to allow of its being carried on continuously. If a house is done up for the summer, the paint then executed in the spring is chilled by the cold and ruined by the unsettled weather. Or should the painting be performed later, say in the months of June or July, the hot sun dries up the oil, the really effective preservative property of the paint, before it can be absorbed. Such work is consequently worthless at the end of less than two years, whereas were it done at a later period the result would be a better appearance, lasting for perhaps double that time. Aspect should also be considered when external painting is required to be performed.

The Chairman (Mr. SCOLLS, V.P.) in reference to Mr. Wyatt Papworth's remarks on varnishing without painting, stated that the late Sir Anthony Carlisle had the interior wood work of his house in Langham Place, so varnished throughout, and the effect of the varnished deal was very like satin wood. The wood-work of the Swiss Cottage at the Colosseum, in the Regent's Park, was also only varnished.

Mr. C. H. SMITH, H.M., said, that in recommending the use of varnish, it was necessary to state

what kind should be used. Any resinous substance in combination with an oil would produce a varnish; but the difference between a resin and a gum, which might resemble each other in outside appearance, should be clearly understood. A resin proper would mix with oil, but not with water; whilst a gum proper would mix with water and not with oil. After mixing a resin with any volatile oil, such as alcohol, spirits of wine, or oil of turpentine, and applying it to any substance, the oil would rapidly evaporate, and leave the resin in a powdery state, which could easily be sponged off. Many years ago he had applied mastic varnish to some drawings, but only a small remnant of it now remained, and a sponge would at once expose the surface of the paper. But if used with a less volatile oil, the varnish would produce a totally different effect, and, for wood-work, only copal varnish in oil should be used. This would give a very hard surface, as might be seen on the panels of carriages. Besides Sir A. Carlisle's house, he might mention a house built about the year 1813 at Brighton, by the late Mr. Bonomi for Mr. Prince Hoare, in which the joiners' work was varnished, and it was in a very good condition many years afterwards, the varnish having acquired a very dark rich colour. With regard to cleaning paint, a solution of wood ashes was frequently employed formerly for washing either linen or paint. This mixture, if too strong, had a tendency to decompose the paint, and careless use of pearl ash and soda would wash off all the paint, though if used gently it would effect the object required. With regard to paint, the only valuable quality of white lead was its extreme density. In the course of his early experiments he had tried to make a pigment from sulphate of lime, using the finest plaster of Paris; and, although this made a beautiful pigment, there was no body in it. This material was applicable to water colour painting, if mixed with a very little gum to prevent its brushing off. It had advantages over the white generally used for water colours, and made of lead or zinc; and if the slightest film of it were used it would be almost transparent when laid on, but when dry intensely white. In experimenting upon magnesian limestone he had found that magnesia was also applicable as a water colour. He did not know of any sulphate or mixture of sulphur that would have any effect upon it. It was totally unaffected by the vapour from sewers or drains, and therefore superior to white lead for distemper painting.

Mr. J. G. CRACE, C.V., said that the best way of treating wood was simply to varnish it, and not to smother it over with paint. Eight or ten years ago he had been employed to paint a house in the Isle of Arran for the present Duke of Hamilton, and he had found the wood work, of red pine, so free from knots, and so well executed, that he suggested that it should be at once varnished. This was done with great success, and the work had lasted, and looked now as well as when it was done. He believed paint had not been used as a preservative to wood before the time of William and Mary; before that time painting was a decorative process. The style of architecture and the use of wood seen in the buildings of William's day, came altogether, he thought, from Holland. Mr. Crace referred to a document in his possession, being a tender for painting the work at Greenwich Hospital in the year 1696, by William Thompson. The price asked for painting outside work three times in oil was 8d. per yard. There was also a price for painting sashes, iron bars, and inside work, and for painting "three times in good linseed oil and well primed." Mr. Crace also referred to papers alluding to the "walnut" and "wainscot" colours mentioned by Mr. Wyatt Papworth. Among these were charges for "all outside painting 3 times in oil, at 8d." and for "all inside, walnut or wainscot, 9d. per yard;" these prices shewed that graining was not intended. At this period (1696, seven years before the accession of Queen Anne,) he believed painting was chiefly executed in white; for in cleaning off the paint from old wood work of that age, he almost invariably found that the original colour had been white. A blue tint was afterwards used, and, in the time of George the Third, various shades of stone colour and drab. Graining and marbling were introduced into this country about the year 1752.

Mr. Crace stated that his father (now far advanced in years) remembered their introduction by French workmen at Carlton House for the Prince of Wales; they were then considered as great novelties, or at all events as a re-introduction. With regard to the operations of painting, he could not too earnestly urge the necessity of careful "knotting," the neglect of which could not afterwards be remedied. The evil arising from this neglect was constantly seen in the common application of two coats of builders' paint, after which the dark spots shewing the forms of the knots soon became visible. For bad work a remedy might be found in rubbing down, sand papering, or pumice stoning; but bad knotting could only be got over by scraping down to the knots themselves, and re-doing the work from the beginning. The use of size color was also to be guarded against, as its application in the first instance prevented the absorption of the oil paints by the wood, and all the after processes only formed a skin laid on the wood work, rather than a coating to effect its preservation. When the sun (as in a window-shutter for example) struck upon wood sized before painting, it was sure to crack and flake off. With regard to pigments, Spanish white was only whitening; none but those with a metallic base had any body at all. White lead furnished the best body that could be applied to wood work. Zinc paint possessed several valuable qualities, but it had very little body. Any one who had used it would know that after even seven or eight coats the grain of the wood could be seen; and he would call particular attention to the fact that zinc paint would not clean well. It had a face which might be compared to wax, and any attempt to clean it seemed to rub in the dirt, so that a bright clear surface could not be got, as with good lead paint. To clean paint he strongly recommended that the raw alkalies should not be used, as they would infallibly take off the flaking coat. The best mode of cleaning was by means of good soap, not too strong, laid on with a large brush, so as to make a lather; this should be washed off clean with a sponge, and wiped dry with a leather. With regard to varnish, nothing but copal should be used, as no other would stand wear so well. It was the most expensive of all varnishes, and therefore could not be applied good in cheap work.

In reply to an enquiry if there was any practical disadvantage in applying zinc paint upon previous coats of lead, Mr. Crace stated that the manufacturers of zinc paint appeared to have come to the opinion, that it was best applied as a finish upon a body of lead. Zinc paint had a good colour, particularly if of fine quality; and under favourable circumstances, would last well. Some experiments which he had tried in a long corridor at the Houses of Parliament, under the direction of Sir C. Barry, where the manufacturers of the zinc paint conducted all the operations, seemed to shew that there was practically no difference in the durability of good white lead and good zinc paint.

Mr. G. GODWIN (Fellow), said that the testimonials in favour of zinc paint were very strong, and if it had no other advantage, its prevention of the misery arising in the shape of painter's cholera, loss of hands, &c., from the use of lead, would make every member of the profession anxious to use it. His own limited experience had furnished him with two cases of failure, which he was told had arisen from applying the zinc without cleaning off the coats of lead paint underneath; and the intended white paint had turned out to be nearly black. Mr. Wyatt Papworth's paper had brought many valuable facts together, and would no doubt lead many to understand why one person could do painter's work 30 per cent. cheaper than another, and yet get more money by it. He moved the thanks of the meeting to Mr. Papworth for his paper.

Mr. ASHFITEL (Fellow), referred to a large public dining-room in the City, where he had employed zinc white, with a satisfactory result, upon coats of red lead, and found that it was not affected by gas-light as lead paint was.

Mr. JENNINGS (Fellow), observed that the use of paint had the advantage over ordinary varnish, that besides protecting the work it gave it a harder surface, and enabled it to bear a severer blow

than if varnish had been employed. French polish produced the best effect; but if two coats of copal varnish were applied, and then polished, the effect would be as good, and the surface as hard as if the work had been painted.

Mr. THOMSON (Fellow) referred to a case in which a pair of wainscot doors were carefully finished, rubbed down, and hand polished to a satin surface. One side of these was afterwards varnished, and the effect was it bore out upon what was termed the figure of the wood, and it sunk into the softer parts; so that it not only produced a rough appearance but also changed the actual texture of the wood, which, on being touched by the hand, was as coarse as a rasp, and some excellent work was spoiled by the experiment.

Mr. CRACK said, that in the experiments at the Houses of Parliament, to which he had referred, it was clear that the zinc paint had not the marked superiority which was claimed for it. On the sanitary question he added, that the workmen did not like it so well as the lead paint. They said that it smelt sour, and made their throats sore. He had in his establishment men who had worked there more than five-and-thirty years with lead paint, without having a day's illness. He believed it depended entirely upon cleanliness, and among the various artisans employed by him, he would match the painters against any others for healthy-looking men, and steady well-conducted workmen.

Mr. L'ANSON (Fellow) referred to a case in which zinc paint (mixed, he believed, with varnish), had been applied over distemper, and the work had stood remarkably well. His own experience was, that it required five coats of zinc to produce an appearance equal to four coats of lead paint. He found that the workmen nauseated and disliked the use of zinc more than that of lead; but he could not say whether the permanent effects of the latter were most deleterious or not.

The CHAIRMAN referred to the green-houses in the Palace Gardens at Salisbury, which had been painted last year, but the appearance of which had led him to ascertain that zinc paint had been employed, and that the result, he thought, was unfavourable on the score of durability.

Mr. DIGBY WYATT (Hon. Sec.) said, that in any fine revival of the ancient or modern Italian styles of decoration, the effect of the other tints employed depended mainly on the brightness, purity, and durability of the white; and the most beautiful rose tints were obtained through the slightly transparent upper coat of white. In the use of lead paint, or other materials which had a tendency to turn yellow, this important advantage was lost, and it was desirable therefore to consider any material which appeared to possess a character of permanence and purity, with a view to arrive at something like the white pigments which the ancients obtained from their fine white marble.

The vote of thanks to Mr. Wyatt Papworth was carried unanimously, and the meeting adjourned.

MEMOIR OF LOUIS DE ZANTH, ARCHITECT OF THE KING OF WURTEMBERG
CHEVALIER OF THE ORDER OF THE CROWN OF WURTEMBERG, HONORARY
AND CORRESPONDING MEMBER OF THE ROYAL INSTITUTE OF BRITISH
ARCHITECTS, AND CORRESPONDING MEMBER OF THE INSTITUTE OF FRANCE.

By THOMAS L. DONALDSON, Hon. Sec. of Foreign Correspondence.

Read at the Ordinary Meeting of the Royal Institute of British Architects, November 16th, 1857.

THE death of a distinguished brother Architect, and more particularly of one, who has been a Corresponding Member of our body, and a liberal contributor to our collection, demands some notice on our part. I feel it therefore to be a duty, which devolves on me as your Secretary of Foreign Correspondence, to seize as early an opportunity as possible to pay that respect to the memory of our departed colleague, Herr Von Zanth, who has by his works well merited a page in the history of our art.

I have reason to believe that he was born about 1798 at Breslau, in Silesia, and was consequently a Prussian subject. His father was an eminent medical man, and chief physician to Jerome Buonaparte during the residence of that sovereign at Cassel. Louis was educated partly at Cassel and partly at Paris, and it is supposed was a pupil at the Lycée Napoleon. Having evinced a decided taste for drawing he was placed at Stuttgard, where his widowed mother resided, under the architect Fischer, Professor of the Polytechnic School in that town. About 1819 Zanth went to Paris, and became the pupil of Monsieur Hittorff, and although he had then made little progress in composition, he shewed an evident bias for decorative detail and great purity of drawing. He followed his excellent master's advice, and took part in the competitions of the School of Architecture; but being of a reflective and deliberative turn of mind, which cannot at a given moment command the imagination, and hence under such a pressure becomes faltering and undecided, he was never able to improvise with sufficient rapidity, and could not accustom himself to the excitement, hustle and clamor, to which the impressionable youth of our neighbours yield, when engaged in such exercises. This circumstance affected his conceptions, and although his "projets" were drawn out with the most elaborate care, he never could carry off a medal. But when left to himself, and to the quiet of his own leisure and reflection, his designs were admirable, and evinced considerable originality and careful treatment.

Zanth from the pupil became the assistant of his friend and master, and in 1823 both went to Sicily with the view to investigate fully and thoroughly the antiquities of that island, which as yet have never been adequately illustrated, numerous and costly as are the works, and learned as the authors, treating upon its ruins. During their stay, Messrs. Hittorff and Zanth were struck by the beauty of the numerous buildings erected since the Greek times, and which adorn the cities of Messina, Catania, Palermo, and other places, erected by the different conquerors of the island, since it was in the possession of the Romans. They therefore took accurate drawings of the churches, palaces, monasteries, hospitals, public fountains, private houses, as also details of altars, tombs,

pulpits, stalls, and other decorative embellishments in the churches, which are marked by a happy freedom of design, novelty, and effective combination. The work, which appeared in the joint names of the authors, was specially edited by Mons. Hittorff, in numbers, between the years 1826-35. The choice of subjects is extremely varied, containing examples of Moorish, Saracenic and Byzantine, as those of Palermo and Mon Reale, and embracing every period of modern architecture without an exclusive adherence to any. The execution of the work is in outline, and may be cited for the judicious selection of the subjects, the purity of the drawing, and exquisite character of the engravings.

At the same time appeared many numbers of their work on the Ancient Monuments. It is to be regretted that this valuable publication has been suspended, from the want of particulars to complete their previous studies, which a personal visit to Sicily can alone satisfactorily supply. It is to be hoped that the survivor may accomplish what still remains a desideratum, a work on Siculo-Grecian architecture, rendered complete by the light of modern researches, and the experience and learning, which have of late years been brought to bear on works of this class, and for the elucidation of which no one has proved himself more competent than Mons. Hittorff.

Zanth was especially struck by the peculiar magnificence of Mon Reale and the Eastern aspect of the Capella Reale and of the Palaces of La Zisa and La Cuha at Palermo, of which he subsequently made some splendid and elaborate colored views to a large size; and in fact this style of art seems to have had a decided influence on his future artistic taste. In 1830 Zanth quitted Paris to seek a new sphere of employment, and returned to Stuttgart, where he constructed many charming town and country houses, perfectly adapted to the convenience of the occupants, elegant in detail, picturesque in their masses. These erections and some of his beautiful drawings were brought under the notice of the King, who immediately appointed him as his architect, and commissioned him to make drawings for a Theatre to be attached to the Palace; but which unfortunately was never executed.

His Royal Patron was desirous to form for himself a kind of special personal retreat or suburban villa, to which he might occasionally retire for the day or a few hours, like those of the Papal families in the neighbourhood of Rome, as the Villa Papa Giulio, or those at Frascati and Tivoli, or as is found in various parts of Germany; or "*magna componere parvis*," like that at Chiswick, belonging to the Duke of Devonshire. It was to consist of a principal casino, hot houses, and conservatories, porticoes, kiosks, a belvedere, ball-room, theatre, and domestic offices, connected one with the other by the general distribution of the garden, which was to be adorned with porticoes, pieces of water and fountains. The Wilhelma is situated at the extremity of the Royal Park of Rosenstein, at a league from Stuttgart and near the town of Cannstadt, famous for its mineral waters, and the gardens extend down to the Neckar. The style selected by his Sovereign was the Moorish. The plot of ground appropriated to the Wilhelma lies on a hanging level, rising from the Neckar, and Zanth found great difficulty in combining its various parts with the grounds of Rosenstein, which had been laid out by an ignorant gardener, without any reference to the undulations of the surface. In order to make himself acquainted with the most celebrated hot houses in England, he came to this country, and visited those of Chatsworth and others, and also studied the application of iron to the various purposes of the forcing-houses, as also its fitness for the arcades, cupolas, kiosques and columns of the porticoes.

On the occasion of this visit he exhibited his magnificent series of Sicilian drawings in these Rooms, and was elected an Honorary and Corresponding Member of our body. The Studies of the

Wilhelma were commenced about 1838: it was the favorite theme of his future existence, the one great object upon which he employed the remaining years of his life. His time, his health, his talents and his means were all devoted to it; it absorbed all his thoughts and aspirations, he seemed to live for it alone with a chivalrous love for his art. I have said, that the King selected the *Moresque Style* for the architecture of his Villa; a style, which has not in our days been adopted for an architectural monument of any importance. With the exception of the edifice called the Mosque in the Schwetzingen Gardens near Mannheim, no serious attempt has been made to reconcile the forms, combinations and decorations suited for one climate, so as to be adapted for another essentially different. The volume of Owen Jones was the only authentic reference for such a style; but of course it is evident, with even this admirable illustration of Moorish work in the Alhambra, that much must be left to the imagination, the taste and the discretion of the architect, to harmonize the fantastic poetry of the style, its brilliant decorations, and its piquant individuality, with the ordinary wants and conveniences of modern European life. Our friend did not fetter himself by a slavish adherence to precedent, nor neglect any means of success; and he employed stone of various colors from the adjoining quarries for the principal buildings, rich colored brick for the offices, and cast iron for various details. The Wilhelma presents a conscientious mastery of difficulties, and the triumph of the architect was assured, when the most renowned sovereigns of Europe, attended by their numerous brilliant suites, found themselves in the Casino, the conservatories, gardens and porticoes brilliantly illuminated, and reflecting the exquisite decorations, which, harmoniously distributed throughout, charmed the eye and satisfied the taste. And although the magician, who had created the fairy scene, was not there, his master spirit delighted the brilliant circle assembled in this truly royal villa.

Zanth has published ten chromolithographic illustrations of the Wilhelma, drawn with the most elaborate patience, truly German; and they were executed by the most eminent lithographers in Berlin and Paris. He spared no expence to ensure the most brilliant result, and one of the plates, the general view, required twenty stones. The French Government, with a liberality that does honor to its love and patronage of art, subscribed for forty copies; it were to be wished, that our own Government felt more alive to the expediency of encouraging in a like manner publications of this class. He presented a copy of this costly work to our Library.

A wealthy landed proprietor in Hungary sent for him to make the plans for a large village, with houses and farms of different sizes, a church, and other public buildings in connection with the restored castle of the Lord. These designs are of the greatest interest; for he scrupulously studied to make them conform to the materials at command, brick and wood, which were alone procurable in the country: and he gave them a national character, elevated by elegant and appropriate combinations and proportions, without departing from simplicity and utility.

Our friend's health had of late years yielded to the unremitting toil with which he followed his art; and absolute rest being necessary he, last year, visited Italy with Mons. Hittorff and family. His anxious friends had hoped, that he might have enjoyed an elegant repose amidst such scenes without the fatigue of thought, and that the fire of his genius might have been rekindled by the renewed contemplation of the noble works of that classic soil. But the tone of his early energy was gone; the languid invalid looked without emotion at those monuments, which he had once regarded with the liveliest enthusiasm, and his residence of some months at Rome was one of suffering and discomfort. While there he received instructions from his King to design a Protestant Church to be attached to the Royal Palace. This he completed, not without great effort, after the Basilica type, and on his

return in June last, presented it to the King, who approved of the conception, and the church was decided to be carried out as designed by him, and to be commenced early in 1858. He had also completed some time since the drawings for a Roman Catholic Church, which it was recently intended to erect after the concordat entered into between the King of Wurtemberg and the Pope.

The death of this distinguished architect occurred on the 7th of October last, and was attended by circumstances, which may remind us of the hero cut off on the field of battle, or the chaplet wreath bound round the head of the expiring victor in the Olympic Games. The Emperors of Russia and of the French met as guests at the court of the King of Wurtemberg, and this Prince, wishing to do all honor to the Sovereigns, gave a splendid fête in the Rural Palace of the Wilhelma. The monarchs surprised and delighted with the magnificence and taste of the fairy scene by which they were surrounded, and by a style of art recalling the fabled and gorgeous scenes of the Eastern Caliphs, rather than the court of a German King, eagerly enquired to whose skill and imagination their host was indebted for the exquisite and varied architecture around them. They learned that it was Herr Zanth, and that he lay at that moment on his bed of sickness. The Emperor of Russia, anxious to express his satisfaction to the artist, sent Prince Gortschakoff at once to the bed-side of poor Zanth to present him with the decoration of Commander of the Order of Stanislaus, and the Prince himself attached to the breast of the sick artist the ribbon and cross of the Order, accompanying the act with the gracious and touching expressions of admiration, which the Emperor had uttered. Zanth was on his death bed, but this act of kind consideration soothed the last moments of one, whose devotion to his art and amiable disposition had endeared him to all who knew him.

Zanth was an enthusiastic follower of architecture; his predilections were for classic art. He was unrivalled as a draftsman for the minute accuracy of every part and the finish of every detail. His large perspective drawings were the most scrupulous possible renderings of the buildings they represented; and although they might want somewhat of aerial effect, yet they were always strikingly effective and grandly rendered. He was extremely susceptible in his feelings, and shrinking from observation. In disposition he was most generous, ever ready to acknowledge talent in others, and most firm in his attachment as a friend.

"No man is a prophet in his own Country," and it is to be feared that the noble, upright, and highly gifted architect of the Wilhelma was not as fully appreciated by those immediately near him, as he was by the Sovereigns of other States and by his professional brethren in other countries, who honoured him as an artist and esteemed him as a man. He had received the Cross of S. Gregory the Great from the Pope; that of the Lion of Zähringen from the Great Duke of Baden; that of S. Louis from the Duchess Regent of Parma, and he was Member of the Academies of Berlin, Munich, Milan, &c.

These few notes consist of the impressions produced by an intimate friendship and intercourse of five and twenty years; but I am indebted for many particulars to our mutual friend Monsieur Hittorf, who was to him as a brother, not merely in art but in affection. Zanth was limited in his friendships. His modest and retiring nature made him instinctively avoid numerous attachments; but the few, who knew him, appreciated the rare moral and intellectual qualities, which made them share in the triumph of his successes, and lament him as one whose loss it is not easy to replace.

ON THE ARTS CONNECTED WITH ARCHITECTURE IN TUSCANY.

By J. R. WAKING, Associate.

Read at the Ordinary General Meeting of the Royal Institute of British Architects,
November 16th, 1857.

THERE is no district of Europe entitled to greater respect from all who honour Art, than was that portion of Italy, during the 13th, 14th and 15th centuries, which we now recognize as the Duchy of Tuscany; tested indifferently by the excellence and variety of its monuments, the spirituality of its artists' productions, or the honourable consideration in which their works were held by all ranks of society. This high distinction was in a great degree due to a fortuitous union of elements in the constitution of Florence in the 13th and 14th centuries, such as may never again recur. The favourable position of the city for commercial pursuits, and probably some congenial sympathy on the part of the citizens, early made it the seat of a prosperous trade in, and manufacture of, woollen goods. Its association with the Ghibeline cause nourished aristocratic feelings of veneration for feudal nobility, while the sanctity of the relics with which its earliest religious structures were endowed fostered, more particularly among the democracy, a fervent devotional respect for everything ecclesiastical. Through these three sources, an enlightened oligarchy, a proud nobility, and an evasive Church, ample patronage was provided for artists; and, as has ever been the case, genius sprang to life in profusion at the all-powerful summons of wealth and honour.

There was however yet one more charm of great potency at work to aid, and which indeed mainly generated, the particular class of excellence to which I propose to draw more special attention this evening:—I allude to that particular veneration for technical excellence, and honest work, which the municipality expressly desired should characterize every work of art for which they gave a commission. Men whose fortunes had been made by the reputation of their skilful weavers, and of their sterling florin,—the only pure gold coin of its time,—could scarcely tolerate in those magnificent structures which were to be the outward and visible emblem to foreigners of their state, either bad work or dishonest material. Handcraftsmen of all kinds were honoured each in their several degrees; guilds and confraternities were erected with special privileges, and the services of all were enlisted to brighten with every external magnificence the pageants of the community, and the monuments of Architecture and its sister arts, which were to be produced for the public enjoyment, and yet more for the public honour. The triumph of the artist was to Florence the triumph of one of its skilful children, whose talent was the manifest source of ease and prosperity to all. Hence the public rejoicings in the "Borgo-Allegro" over the strides made in painting by Cimabue; the public gratulations over the exquisite manipulation of marble work and mosaic by Orcagna in the Or San Michele—over the brilliant ability of Donatello, Ghiberti, and Luca della Robbia, in sculpture, and over the originality of Giotto, and the daring of Brunelleschi in architecture.

The public buildings in those palmy days of art were looked upon as demanding the co-operation of all; and as each man who brought of his best to the work received at the hands of his fellow citizens, both in money and good esteem, the full value of whatever he added to the common stock of beauties, neither the greater men were permitted to appropriate the honours of the less, nor were the less permitted to flinch the credit due to the loftier spirits. Hence arose a co-operation among artists and artisans of all kinds such as has been scarcely ever known in the world's history,

and hence is derived much of the peculiar excellence and interest of the principal structures time has spared to us upon the almost classic banks of the Arno.

It had been my intention this evening to dwell upon many of the technical arts which contribute to this excellence, but heavy and unexpected engagements have curtailed the time at my disposal, and I have been forced to limit my attention to three of special interest:—viz. Stained Glass, which has not received the attention it deserves at the hands of art students; Painting in fresco, which is so eminently characteristic of all early Italian architecture, and Tuscan in particular; and Marquetry, of which Tuscany appears to have been at least the European nursery.

Amongst all the arts connected with Architecture, there is not perhaps one so capable of imparting splendour to a building as that of Stained or Painted Glass; a fact which appears to have been known and practically applied from the earlier period of the Christian era to within the last century or two. In the first recorded examples nothing more appears to have been attempted than filling in windows with a species of mosaic-work of different coloured pieces of stained glass; nor is it until the eleventh or twelfth century of our era that we have satisfactory records of the application of figure-subjects in this method of decoration,—a system which reached its apogee, with all the other decorative arts, in the fifteenth and sixteenth centuries. There are three methods of executing these glass pictures, which may be termed the Mosaic, the Enamel, and the Mosaic-Enamel. In the first, the composition is formed of small pieces of stained glass, or glass coloured throughout by metallic oxides, termed pot-metal, welded together in small pieces, and producing all the required tints in local colour; the shadows, which are slight, are produced by the application of enamel colour upon them with a brush, and then fixed by burning in a kiln; the best examples of this class are, perhaps, those of the twelfth and thirteenth centuries. In the second, or Enamel method, which was most in vogue during the sixteenth and seventeenth centuries, the artist painted his subject entirely with enamel colours on a ground of white glass, sometimes on one side only, sometimes on both; the entire design being welded together in pieces of much larger size than those usual in the Mosaic method; and, when complete, fixed by exposure to heat in a kiln. In the third, or Mosaic-Enamel method, we find a combination of both the former: it was most in vogue, as might naturally be supposed, at a transitional period between the first and second methods, and is indeed characteristic of the works of the fifteenth and of the early part of the sixteenth century. In this method, the use of pot-metal for the large masses of colour imparts all that brilliancy and power which is peculiar to the material; whilst the use of enamel colour for the more delicate portions of the picture, as the flesh, the hair, the ornaments, and the general accessories, permits a delicacy and minuteness of finish otherwise unattainable. The drawings now exhibited are principally illustrative of this method of glass painting. In these it will immediately be seen that the figures are all-important, and that the ornamental portions are merely accessories. It may here be well to notice some of the objections made against this practice of paintings or pictures on glass. "The first (according to Mr. Winston,* who has paid great attention to the art) being the supposed unsuitness of the material for any sort of representation more pictorial than the mosaics of the twelfth and thirteenth centuries; the second, the supposed impropriety of representing a receding picture on the wall of any building: in support of the first ground of objection, we are told that a glass painting reverses the conditions of Nature, by making the lights transparent and the shadows opaque; that the violence of its colouring is wholly opposed to pictorial effect; and to bound objects with black lines, is reprehensible on every artistic consideration. The first of these arguments is at once disposed of by

* "On the Application of Painted Glass to Buildings in Various Styles of Architecture."

the observation that we have nothing to do with anything but the *effect* of a glass painting; and that when the material is, like that of the cinque-cento period, of a horn-like texture, the high lights do not appear to be less solid than the shadows. . . . The remaining objection, that it is wrong to represent a receding picture on the wall of a building, and consequently in a window, the glazed surface of which is but a continuance of that wall, seems to rest less on a consideration of facts, or the dictates of our external senses, than on a sort of mock philosophy, which seeks to escape laborious investigation by the enunciation of a 'principle;' than which, by the way, nothing is more easy. It may be conceded, that to carry a receding picture all round a room produces an ill effect; but pictures, though representing the effect of depth and distance even almost to illusion, are admitted to be allowable, provided they occupy only a portion of the wall, either by being hung against it in a frame, or by being actually painted upon it,—the latter sort indeed can plead the testimony of ages in its favour. If, then, a glass painting should have the illusion of distance, it would be unobjectionable, because, necessarily, it would occupy only part of the side of the room or building containing it. And as we are accustomed to see out of a building by looking through its windows, those who mistook the painting for a real object, might easily stretch the imagination a little further, and conclude that it was some object placed outside the building, until its unreality became apparent, from the figures continuing to remain motionless. . . . It might indeed sometimes happen, that, for the sake of preserving distinctness at a very great distance, a glass painting in which figures were represented on a flat ground, would be preferable to one having a receding background; but I think that the glass-painter need be deterred by no other consideration from employing a receding background, if he thought proper. Indeed, a glass painting having a sky or landscape background, such as we meet with in good cinque-cento examples in general, would be peculiarly suitable for a window at the end of a building, on account of the retiring nature of most of its hues. I conclude therefore that, in the preparation of painted windows for classical edifices, the artist has the choice of a more or less severe style of representation, to be used according to the character of the building he is required to decorate; and that the type of the one style is to be found in the remains of the twelfth and thirteenth centuries' mosaics, and the type of the other is to be found in the glass paintings of the second-quarter of the sixteenth century." In these remarks I heartily concur, only substituting for the second type, the works of the close of the fifteenth and the earlier years of the sixteenth century in place of the second quarter of the sixteenth century, at any rate as regards examples existing in central Italy.

The deep and brilliant tones, the fine drawing, the simplicity, and the solidity of the examples of the fifteenth century in Tuscany, resembling in character the best productions of the early Venetian painters, gave place to works of a more ambitious but a more flimsy nature; and we perceive in the first quarter of the sixteenth century a complete divergence of style in the great windows of the Cathedral of Arezzo, executed by William de Marsiglia, or Marcilla, in the year 1523. The qualities alluded to in the fifteenth-century subjects are lost; and the praise of Vasari, who describes them as something rained down from heaven as a consolation to mankind, is certainly due rather to the Florentine and Lucchese examples, than to these somewhat flimsy and straggling compositions: but Vasari was an Aretine. About this period also works in *grisaille* became very frequent. These are painted with enamel monochrome, on a white field; and, though very ineffective, are pleasing, from the fancy and skill exhibited in their execution. Such are the windows of the Laurentian Library at Florence, designed, if not executed, by Raffaele's favorite pupil, Giovanni da Udine, about the year 1540. Contemporary with this fashion, a richly-coloured system of glass painting, by Swiss and

German artists, was much in vogue; generally on a much smaller scale than that hitherto practised, being chiefly used in civic and private residences. At the end of the fifteenth and during the sixteenth century, and even later, Nuremberg, Ulm, and Freyburg, in Breisgau, were especially famous for works in this style; but this last fitting gleam of departing splendour, had, by the eighteenth century, nearly died out, and from that period glass painting, in common with all the decorative arts, as applied to Architecture, fell into desuetude and decay.

In the revival of this art during the present century, the artists of France, Italy, Belgium, and Germany have taken the lead, and far surpass any efforts made by the English; yet in the best of these there is much that is unsatisfactory, and neither in drawing, colour, nor solidity, do they bear any comparison with the best works of the fifteenth and sixteenth centuries in Tuscany. This arises principally from an insufficient adoption of pot-metal in the masses of colour, the false idea that the numerous lead lines of the small pieces of glass in the mosaic method are antagonistic to the general effect,—the contrary, I believe, being certainly the case,—the insufficient use of large masses of shadow, and too minute attention to blending the several local colours: such were the defects which struck me in the otherwise beautiful works of Capronnier of Brussels and of Bertini of Milan, in the Great Exhibition of 1851, and in those of Petit Gerard of Strasburg, of Lafaye, Gérante, and Lussan of Paris, and of Vincent Larcher of Troyes, in the Paris Exhibition of 1855.

The notices of the magnificent stained glass windows of the Duomo of Florence are very meagre; some of them are merely stated to have been executed in 1434 by a Florentine artist, Domenico Livi da Gambassi, at Florence, who had learnt the art at Lubeck. This may apply to the series of which an example is given, though that even appears improbable, and some of the subjects in the upper windows of the transepts, of which St. James is an example, are certainly of much earlier date. The entire series is remarkably rich in colour, and consists of the prophets and kings of the Old Testament, and the Apostles and Saints clad in most picturesque and striking costumes, such as Freiligrath describes in his "Pictorial Bible," presenting a fine example of those "storied windows richly light" which Milton has celebrated in verse.

They are formed of small and irregular pieces of stained glass, and in the *ensemble* present no extreme delicacy of execution nor peculiar depth of shadow; the effect being obtained by a rich combination of colours, excellently arranged, and very much in accordance with the scientific principles enunciated by M. Chevreul: the robes are seldom of one plain tint, but are richly worked with ornamental patterns of a bold and effective character. The faces and drapery are seldom strongly marked in shadow; and the former, though in some cases, as in Moses and the king, very finely expressed, yet in others, as in St. Simplicius, are very rudely formed,—a defect however not easily remarked at the distance they are placed from the eye, whilst the object which the artist evidently sought, namely a rich combination of colour, is perfectly obtained. The dark leaden lines with which the small pieces of glass are welded together, without any regard as to where they occur, are also lost in the distance; while the important result is produced by means of these black lines, that much greater solidity and a much stronger effect of colour are obtained. They give increased contrast and distinctness to the separate colours and to the entire composition, which, if not treated in this manner, is apt to become confused and flimsy-looking even at a short distance: indeed it may be taken as a general axiom, that the blending of tints, unless in subjects very close to the eye, should be avoided in stained glass as simply labour thrown away.

All the figures of the series are nobly designed and full of character. They are represented standing or seated beneath niches or recesses, shown in perspective, inlaid with various-coloured

marble in panels, at the back of which is shown a deep blue sky. Many of the inscriptions are formed of yellow letters on a black ground, and the ornamental borders, of simple and effective design, are remarkable for their resemblance to those executed during the thirteenth century in England.

The painted windows of the choir of S. M. Novella, at Florence, are amongst the most remarkable and effective examples to be found in the Renaissance style: they are stated to have been executed by Alessandro Fiorentino in the year 1491.

The triple window of the choir, each side-light of which contains three figures of saints in niches placed one over the other, surmounted at the top by a dome, presents a mass of powerful and brilliant colour, an excellence of design and execution, and a breadth of light and shade, such as can seldom be met with; and when the setting sun throws its rays full on this window, nothing more wonderfully gorgeous can be conceived. It is then we arrive at the conviction that it is only by painting on glass, that the colourist can hope to obtain effects to vie with the most beautiful tints of Nature, as seen on birds, insects, shells, jewels; in comparison with which the greatest efforts of the Venetian and Dutch schools, of Delacroix or of Ety, appear dull and lifeless: this may be accounted for by supposing, that in the case of an oil painting, the image is impressed on the retina of the eye by reflected light, whilst in that of a window the object is cast on it by direct rays.

In these windows the designs are still composed of irregular pieces of glass, without any regard as to where the lead lines may occur, except in the faces, and even then, occasionally the artist was not very particular. The pieces of glass are however generally of larger size than those in the Duomo. There are very few portions left perfectly white, and the lightest coloured are always of a warm cream or light straw tint, the shadowed portions hatched in with rich brown bistre lines: the skin is generally of a rich, somewhat red, sienna tint, with warm brown shadows; and all the latter are strongly marked, especially in the draperies; indeed the whole system employed reminds us of the great school of early Venetian colourists, represented by Cima da Conegliano, Marco Basaiti, and Carpaccio.

The features, extremities, and anatomy (when seen) are excellently drawn; the faces of the men are characterized by a manly nobility of expression, and those of the women by much sweetness and grace. The artist has felt himself at liberty to apply colour arbitrarily to the architectural accessories: there is little attempt to be master-of-fact in these aerial buildings, which glitter with all the splendour of works composed of the most precious stones and jewels; and when masses of colour occur, they are generally rendered luminous by small bright dots on a darker ground of the same tint. In the draperies we observe two particular kinds; the one black, which, lightened by some pattern, such as white stars, becomes of essential service as a key and a contrast to the brighter colours; the other, dark purple, which is of incomparable beauty. As I have already noticed in all the former examples, the lead lines serve to give distinctness and force to the whole design.

The borders of these windows are boldly designed and very effective, and plainly shew how much labour is frequently wasted in the minute ornament too often seen in modern stained glass.

Central Italy is rich in similar works, and it appears extraordinary that more attention has not been given to them. Amongst these may be more particularly mentioned, at Florence, the very rich early Florentine Gothic windows of Or San Michele; the Gothic windows of the aisles in Santa Croce; several windows in the Duomo, said to be executed from the designs of Ghiberti and Donatello; the great circular window (the Descent from the Cross) by Ghiberti, in Santa Croce; and the circular window of Santo Spirito; at Lucca, the cathedral, and the church of San Giovanni; at Siena, the great circular window of the cathedral, designed by Pierino del Vaga, and executed by Pastorino of Siena in 1549, and some good pieces in the church of Fonte Giusta; at Pisa, in the Duomo, rich

in colour, but confused in design; at Prato, in the cathedral, somewhat coarse and crude; the large windows of the cathedral at Arezzo (sixteenth century), and the lancet windows of the choir of much earlier date; a circular window in S. Francesco, and some excellent examples in Sta. Annunziata; the very fine Gothic window of the choir of San Domenico, at Perugia; and the entire series of windows in the lower and upper church of S. Francesco, at Assisi, principally of the fourteenth century, —works of a remarkably ornamental character.

Proceeding now to Fresco as an ornamental adjunct to architecture, we find that between the Byzantine epoch, when mural decoration could boast of the rich and solemn effect produced by the use of mosaic inlay, and the revival of the art of painting in the fifteenth century, there extends a long period, embracing the works of the Romanesque and Gothic styles, neither of which has been illustrated in the manner they deserve; an omission arising chiefly from the few remains which exist at this day in a perfect state, at least in the Cisalpine countries. As regards the first-named style, we have frequent records that painting was extensively applied as an internal decoration, where mosaic-work could not be obtained; and we constantly find notices, during the eleventh and twelfth centuries, of the walls of churches being covered with painted subjects, illustrating the Sacred Writings or the lives of particular Saints.

Amongst the names which preceded Cimabue in this art, that of Giotto da Pisa stands foremost; and I would mention the church of San Piero, in Grado, as one of the best-preserved and most complete examples of his epoch, if not of his style, which is now in existence. Cimabue (1240—1300) formed a style transitional in its character, which still retained most of the conventional dispositions of mural decoration and figure drawing, on which however is grafted a return to natural models; but to Giotto (1276—1336) is due the complete formation of a new school, in which the study of Nature, and a certain development of the antique Roman style, preponderate over the conventionalities of the Byzantine school. From this period may be dated the true revival of the art of painting (principally in fresco) in Italy; in the advancement of which stand prominently forward the names of his contemporaries, pupils, and followers, such as Simone Memmi of Siena (1270—1344), Taddeo Gaddi of Florence (1300—1352), Spinello Aretino of Arezzo (1308—1400).

The general characteristics of this Italian Gothic, or Giottoesque style of mural decoration are,—a dado, or base, panelled with imitations of various marbles, contained within borders painted in imitation of the glass mosaic-work usually known as *Opus Grecanicum*, having at times central designs of intricate geometrical and leaf ornament. About six feet from the floor is a cornice with small brackets or consoles, all radiating in perspective to a central point of sight: above this the wall is divided into large compartments, containing historical or religious figure subjects, the figures being strongly outlined, and the colours flat and distinct, with but a slight use of *chiaro-oscuro*; these compartments are also enclosed in painted mosaic borders, and beneath each there is a description of the subject illustrated, written in peculiar Gothic letters of a very good style. The vaulting of the roof springs immediately from above these pictures, the only actual projection being one large central rib, ornamented with winding foliage and mosaic borders, and painted mouldings to carry it more agreeably on to the flat surface of the vaulted compartments, which are almost always painted of a deep blue, studded with gold stars, and in the centre of each of which are painted figures, usually holding written scrolls descriptive of their meaning. Sometimes the names are written on the clouds beneath, from which they frequently appear to rise. The intersection of the rib is marked by a gold boss, carved and gilt, but not of great size, having a ring in the centre, from which a lamp was suspended. The ornament is generally a mixture of mosaic-work, Roman reminiscences, especially in the painted mouldings, and transcripts from Nature; the two first however being predominant. The

colours are well arranged, and the ornamental accessories, such as dresses, buildings, thrones, armours, etc., are of great variety and beauty, and very carefully executed.

Such are the general characteristics of most of the mural decoration in vogue up to the close of the fifteenth century, as seen in the works of Orcagna at Pisa and Volterra, of the Lorenzetti and Bartoli at Siena, and in the several Italian schools of Italy. And although the works of Paolo Uccello, Masaccio, Ghirlandaio, and Signorelli present many points of divergence, the principal feature being the greater importance attached to the historical subjects and a very superior style of execution, yet it is not until the time of Perugino that we find a completely different system adopted; and to him appears to be certainly due the introduction of a style in every way superior, which was extended and improved by his contemporaries and pupils, amongst whom Pinturicchio and Raffaele are most prominent.

I will now bring under your notice the last division of my subject, which is the art of Marquetry, or inlay in wood. Although a passage in the treatise of Theophilus on Painting (twelfth century) appears to bear on the practice of working in several kinds of wood,—“cupri, ferri, lignorum, lapidumque,”—yet the earliest examples with which we are acquainted are to be found on the ivory boxes, ornamented with inlay of various-coloured wood, chiefly manufactured at Venice during the fourteenth century. In these the art was only employed as an adjunct; and it is not until the close of the fourteenth or the commencement of the fifteenth century that we find it applied as an ornamental art by itself, and developed on large surfaces. Vasari and Lanzi state, that Brunelleschi gave lessons in perspective and tarsia, to architects and others, of which Masaccio, in painting, and Benedetto da Maiano, in his inlaid works, availed themselves. Vasari says that several works of the kind were executed by the old masters, “da nostri vecchie,” and were termed by them works in “tarsia,” or intarsiatura. In his life of Benedetto da Maiano, he states that this practice was first introduced in the time of Brunelleschi and Paolo Uccello, “that, namely, of conjoining woods, tinted of different colours, and representing with these, buildings in perspective, foliage and various fantasies of different kinds.” The earliest artist in this manner mentioned by Vasari, is Giuliano da Maiano (1432—1490), architect and sculptor, who commenced his artistic life with works in tarsia, and executed, as his first work, the seats and presses of the sacristy in the Church of the Annunziata at Florence, with Giusto and Minore, two masters of tarsia. Other works of his are mentioned by Vasari, in the abbey church, Fiesole, and San Marco, Florence. Giuliano, on his employment as architect, left tarsia-work to his brother Benedetto, who became a celebrated artist in that style. Some of the presses in the sacristy of the cathedral of Florence are by him: and especial mention should be made of the door of the audience chamber in the Palazzo Vecchio, executed by him or by Giuliano, representing Dante and Petrarch in ornamental borders, etc., on each leaf of the door. Other artists in this style, mentioned by Vasari, are Baccio Albinì and his pupil Girolamo della Cecca, pipers to the Signoria, who worked also in ivory, when Benedetto was yet a young man; David of Pistoia, and Geri of Arezzo, who decorated the choir and pulpit of Sant’Agostino in that town; Giusto and Minore, his assistants, and Guido del Servellino and Domenico di Mariotto, his pupils, in the Duomo of Pisa, all of whom belong to the fifteenth century. Lorenzo Canozio da Lendinara, a fellow-student of Mantegna, who died about the year 1477, is stated in his epitaph to have inlaid the choir of Sant’Antonio at Padua with tarsia-work. One of the greatest names in the art, however, is that of Fra Giovanni da Verona (sixteenth century), who, according to Vasari, in place of the dark and light woods of two or three tints used by the Maiani and their followers, gave artificial colours to his wood inlay “by means of waters, coloured infusions, and penetrating oils: to obtain brilliant high lights he was accustomed to use delicate slips of willow.” F. Vincenzo dalle Vacche is mentioned by Morelli in his “Notizia,” as excellent in such work, particularly in the church of San Benedetto Norello at Padua. Fra Raffaello da Brescia, of

Monte Oliveto, ornamented the choir of San Michele in Bosco at Bologna. Sabba Castiglione, in his "Ricordi, ovvero Ammaestramenti" (Venezia, 1562), mentions the Legnaghi as good artists; and the Dominican monk, Fra Damiano da Bergamo, as the most celebrated of the sixteenth century "tarsiatori." The varied colouring was produced by chemical fluids and oils, with the aid of shadows burnt-in; but Fra Damiano's best works, in which he was assisted by Fra Antonio Asietelli, are not in colours, but the effect is aided by burnt shadows. Other works of his mentioned by Lanzi, are in the Dominican church at Bergamo, and in San Pietro dei Casinensi, Perugia. Gian Francesco Capo di Ferro, is spoken of as working also at Bergamo. Other fine works are to be seen in the choir of the Certosa, at Pavia, by Bartolommeo da Pola, in 1486; in the choir of the cathedral at Siena, by Fra Giovanni da Verona; in the sacristies of San Miniato al Monte and Santa Croce, at Florence; and in the Sala del Cambio, at Perugia, signed with the name of Marco Antonio Mercatelli. The tarsia-work of artificially-coloured woods, which Sabba Castiglione eulogises, is not to be found in any of the above named works; and although the practice clearly originated in Italy, it was brought to perfection subsequently in France and Flanders. But the art was in an abnormal condition. The just principles of wood-mosaic, for it is nothing more, transgressed by the Italian artists, spread to a ruinous extent; and thus, in combination with the wretched state into which all the decorative arts fell during the eighteenth century, it gradually died out,—although some fair examples, in two colours only, on articles of furniture, are to be found up to a late period. The art is now revived and practised to some extent, for purely decorative purposes, on furniture. But I am not aware that any advantage is taken of its effect by architects, which those who have admired it in some of the subjects cited above will regret; for it is every way commendable, so long as it is confined to a mosaic of different coloured woods (as in the best examples of the Italian school), without attempts at pictorial effect.

The stalls of the chapel attached to the Palazzo della Signoria at Siena are richly inlaid with marquetry, consisting of allegorical and scriptural figures, surrounded with ornamental borders. They have been ascribed to Taddeo Bartoli (who painted the walls of the chapel in the year 1414), but they would appear rather to belong to the fourteenth century, although it is possible that he may, at an earlier period than 1414, have given some of the designs for the allegorical figures, etc. The central carving, of Romulus and Remus suckled by the wolf, was the "enseigne" of the city of Siena, and beneath, at each angle, is the heraldic shield of the Republic. The central subject of the lower portion represents one of those wheels of fortune so frequently met with in all kinds of material throughout the Mediæval and Renaissance periods. The figures on this probably have a political meaning.

The stalls in the choir of the Duomo at Pisa contain two distinct kinds of subjects in wood inlay; one, a series of Saints, the other, subjects from inanimate nature, flowers, musical instruments, &c. I could find no local information as to the period of their execution, or the names of the artists; they appear however to belong to the early part of the fifteenth century. The busts of St. Paul and St. Andrew, give a fair idea of the quaintness and vigour of design which characterize the entire series. Vasari says that Giuliano da Maiano ornamented the seats of the priest, deacon, and subdeacon, before the high altar of Pisa cathedral, with intersiatura, and that whilst working there employed Guido del Serrellino and Maestro Domenico di Mariotto, joiners of Pisa, to assist him, whom he so effectually instructed in the art, that they afterwards finished the greater part of the remainder; the final completion however was due to the Pisan, Battista del Cervellieri, who executed them, according to Vasari, in a much better manner.

The stalls of the choir in the upper church of Assisi, about one hundred in number, were orna-

* See Digby Wyatt's "Industrial Arts of the Nineteenth Century," and Report to the Board of Trade on "Furniture and Decoration."

mented, at the close of the fifteenth century, with a very fine series of ornamental marquetry subjects, by a monk of the monastery, Fra Domenico di San Severino. In these the graduated tints appear to have been effected by means of burning, and the use of hatched or engraved lines on the light-coloured wood is carried, to a greater extent than is usually found in the process of wood inlay.

The moral that may be deduced from the few observations offered this evening on some out of the many arts associated in the production of the great monuments of Tuscany, is the following:—it has been the great misfortune of Architecture, from the last century up to the present time, to be considered as a study *per se*; as an art perfect in itself, and requiring no adventitious aid from the sister arts of Sculpture, Painting, etc.; but if we search antiquity through, we shall find no example of such a disconnection of the one from the others; and those buildings are the most interesting, the most beautiful and satisfactory, which have sought the aid and guided the aim of all those varied and ingenious methods of ornament, which the skill of mankind has discovered and brought to perfection. It is true that constructive science is of primary importance to the architect; yet it can do no more than form the skeleton which it is his duty to render, not merely useful, but agreeable to the eye; and in order to effect this, he must of necessity call in the aid of the artist in stone, in colour, in metal, in wood and mosaic work, and possess the knowledge and good taste requisite to apply them effectively to his subject; the useful should never be separated from the beautiful; the last is the complement of the first, of which every work of the Divine Creator, the great Architect and Artist of the Universe, affords striking and inimitable proof.

To one deeply penetrated with this feeling, the study of Architecture is no longer confined to the few years spent in an office to obtain a knowledge of the different styles, and the usual methods of professional business, but demands long-continued attention to all the arts of Design, with a view to their general application to Architecture. And here let me say a word on the subject of servile imitation, an evil almost necessarily attendant on the revival of any style or manipulative art. Novelty and beauty excite admiration, and naturally produce imitation; but this will be only for a time; for we should not be human beings if finally we did not endeavour to strike out a new path for ourselves; and then it is that we shall bring to bear our knowledge, not for the purposes of imitation, but of progress. With all just deference to the studies of our predecessors, with all our admiration for the styles of the past, our present object should be to consolidate and arrange the information we now have; and from the lessons thus gained, the examples thus given, strike out a new path for the powers of the Architect, and bring back the art to its normal state, which is one of gradual but sure progress, founded on scientific and artistic knowledge: we should perceive that merit exists more or less in all styles, and is irrespective of fashion, which is mutable and often unjust; that the *principles* of our art are fixed and certain; that however much long-received rules may be altered as circumstances may require, they are not to be despised or disregarded without careful consideration; that true construction is the vital principle of real progress; and that, besides the excellent and numerous examples of ornament we already possess, Nature has still varied and inexhaustible resources in store for our study; and above all, that for the appliance of those means at our disposal, an earnest study, a just appreciation, a practical knowledge of *all* Art, are indispensably necessary, and can only be obtained by an industrious use of the hand and of the eye, as well as of the mind.

But to what purpose should we do this? What incentive has the architect of this country, and this day, to undergo an education of so protracted and so difficult a nature? Let it be owned at once, that the artist's own improvement, and the development of his own powers, with the personal pleasure consequent thereon, must be the only reward he can reasonably look forward to. Such studies for an architect are "as caviare to the public," that public which requires builders not artists, and looks with

jealousy and distrust on any architect who thinks more of his profession as an art, than as a trade: How differently was the architect of the 15th and 16th centuries in Italy situated! In Tuscany especially, that classic home of art where the old Etruscan spirit, though dormant for centuries, rose from its temporary grave in all the glory and majesty of a bright resurrection, the appreciation and admiration of the public were not confined to one art or to one set of men, but to every thing which was calculated to lend a grace and charm to all the requirements of civilised life. The church, the government, the municipality, the noble, the wealthy merchant, delighted to honour all that related to the arts, and the artist might labour contentedly at his own improvement with the certain assurance, that the better he succeeded, the wider and deeper his studies were, in that same measure he might count on the applause and appreciation of his fellow citizens. After all to the generous mind, what reward in money, what payment, however great it may be for services as a man employed to do a certain work, as a servant in fact, can compensate for the want of appreciation as an artist? but not for this let us falter or be cast down, the good work must still go on, and though the task be a thankless one, though the seed be cast on a stony and rough soil, yet it is necessary to proceed, trusting that in the future such studies will bear fruit, and be of service to our country. It was this variety and catholicity of study which invested the architects of Mediæval Tuscany with so much glory and romance; with them architecture was regarded in its just light as the leader and employer of all the arts, which were pressed wisely and with great success into its service, and the examples which we have before us this evening, serve, but in a very slight and partial manner, to afford some idea of the richness and beauty of Italian architecture, whether of the Mediæval or Renaissance periods, and show how like a beautiful garden of delight was that architecture, in which, not only the noblest trees of the forest were allowed to spread their umbrageous foliage, but in which bloomed with fragrant scent, every plant and flower that could be culled from the wide field of Nature.

Mr. DONALDSON (H.S.F.C.) said there could not be in all Europe a more striking example of the want of all those adjuncts of art so ably described by Mr. Waring, and which were necessary to form a complete picture, than St. Paul's Cathedral. Mr. Waring had observed that the useful should never be separated from the beautiful; and the converse proposition was equally true; indeed beauty was necessary to give expression to utility, and to bring it home to the mind and the feelings. Viewed externally St. Paul's was a building of considerable size and harmonious proportions, but no one could look at the interior without feeling a chilling effect, from the want of a combination of the subsidiary arts necessary to render it impressive. If this edifice had been completed with stained glass windows, and with frescoes on its walls, its effect, as the most glorious work, abstractedly considered, of the greatest architect of this country, would be to impress every one with far different feelings. The poor and niggardly works of this country afforded a strong contrast to such buildings as the Church of St. Vincent de Paul at Paris, which had cost from £90,000. to £100,000. That was indeed a work worthy of the nation. The windows were all beautifully painted, and each of them formed a part of the architectural whole, whereas in buildings in this country the wall was merely cut up by holes for light, letting in all the blaze of day. The Church of S. Gudule at Brussels was another example: in the windows of which there was a series of exquisite cinque cento pictures. These however were discordant with the style; but in St. Paul's such pictures would harmoniously produce the desired impression. Objections might be urged against receding pictures on walls, and to a certain degree, correctly. In a church at Lille the end wall of the aisle was painted in perspective, by which the aisle seemed at first sight to be prolonged, and from a proper point of view, with a happy effect; but on approaching nearer it was unsatisfactory. It was necessary that many branches of art should

be employed to carry out perfectly the ideas of the architect; who should not restrict himself to stone, and to geometrical lines, but rather avail himself of all the accompaniments so ably alluded to by Mr. Waring. Mr. Waring's logical treatment of the question was particularly happy, beginning as he did with an analysis of the beautiful and the interesting, and its application to its legitimate purpose; shewing that he did not look at a building abstractedly, but with reference to the effect produced on the mind of the beholder. In modern Gothic architecture many of the elements of beauty under consideration had been introduced, but from some hesitation in the public mind it had not been prepared to receive a like amount of decoration in classic and Italian buildings; but there could be no doubt that if they had the wish to do so, they had the power, to introduce all the effects and all the advantages of the accessories which Mr. Waring had described.

Mr. FRANKER (C.V.) referred to the engraving published one hundred years ago, shewing the decorations intended for the interior of St. Paul's, as a proof that it was the intention of Sir C. Wren to have had it richly decorated. Owing however to parsimony on the one hand, and puritanism on the other, these decorations had not been carried out.

Mr. DIGBY WYATT (H.S.) said it was but justice to Sir C. Wren to remark that about the best wood carving and iron-work in London were to be found in St. Paul's.

Mr. DONALDSON observed that the engraving referred to did not emanate from Sir C. Wren. The decorations were inserted to shew what should be introduced, but he did not think they were designed by Wren. The plate was not published till 1755, many years after his death.

Mr. C. BARRY, Fellow, remarked that every one interested in art, and especially architects, must feel how very difficult it was to have the whole of their ideas harmoniously carried out. This difficulty arose not only from disputed questions of taste, but from the still more unfortunate fact that nothing good or beautiful could be done without expense. He quite agreed with the remarks upon St. Paul's Cathedral. It should be remembered that the national purse could do what private ones could not, and it was a duty incumbent upon the nation to shew what it could do in this respect.

The motion of thanks to Mr. Waring for his paper was unanimously carried, and the Meeting adjourned.

ON THE FOUNDATIONS OF SOME OF THE METROPOLITAN BRIDGES IN THE RIVER THAMES.

By W. A. BOULNOIS, Associate.

Read at the Ordinary General Meeting of the Royal Institute of British Architects,
November 30th, 1837.

VARIOUS circumstances contribute to the interest which the subject of the Foundations of the Metropolitan Bridges has lately excited. The failure of Westminster and Blackfriars bridges—the various causes to which different eminent engineers have attributed these failures—the difference of opinion which exists as to the employment of compound constructions in works intended for permanence, and the interference of the Board of Public Works when the Chief Commissioner desired to be satisfied of the efficacy of the schemes which had been matured under his predecessors and sanctioned by the Committee of the House of Commons—the reports in the public papers of the dangerous condition of two of the bridges which span the Thames—the formidable stagings and centerings which were encountered by the river steam-boat passengers—the visible cracks, not to say fissures, in large masses of stone masonry, which had hitherto been to the ordinary gaze the very embodiment of strength and stability;—all have contributed to make the London world more than usually acquainted both with the nature of the requirements in any new bridges, and of the means by which those requirements were to be best effected. But we as architects and engineers need not go into the polemical discussion of these affairs, and our interest is sufficiently aroused by the great advances which have been made in nearly all methods of construction, within the last quarter of a century, by the numerous examples of new systems of foundations scattered all over the country in railway bridges, wharf walls, dock entrances, and other works in water, and by the experiences of the French, German, and Dutch engineers, which are for the most part so admirably described in their elaborate publications which reach us, and are accessible to all of us through our association with this and the kindred Institution in Great George Street. Most fortunate has it been for architects and engineers, that the old bridges have been propped up so long, and that new ones have not replaced them, because the experience which has been gained within the last fifteen years by their failures and the remedies applied to them, far exceeds in value the cost of the props and the inconvenience sustained by the inhabitants of the town during their passage either over or under the bridges. The only cause for regret indeed is the immense waste which was occasioned by the fruitless efforts to overcome what a scientific examination into the matter would, I cannot but think, have proved to have been irremediable.

I propose to describe first the foundation of the bridges in the order of their dates of construction. They are probably, at least those of old Westminster and London Bridges, well known to you; but it is very desirable that, at the risk of some tedium, the premises for what I hope will lead to a discussion of the subject, should be laid down.

Westminster Bridge was constructed by Labelye in 1738 to 1747; it consists of thirteen semi-circular arches, in Portland stone, the centre arch being 75 feet span, and its piers being 28 feet wide at the bottom of the footings, the arches decreasing in each span towards the sides, which are 54 feet span, and the piers decreasing each 1 foot. The foundations were laid in caissons; it is supposed that no piles were used at all, but from an old account which I have met with, I am inclined to believe

that some few piles were driven down into loose ground, which was found under the third pier from the Surrey shore. These piles were, I presume, rammed down below the level of the ground, because there is no evidence of the practice of sawing off piles below water being pursued at that time. The caissons were flat-bottomed vessels with vertical sides, which were so constructed as to be removable and to serve for new bottoms. They were constructed on a launching stage, and after the seams and joints had been caulked they were floated into the river and moored over their intended sites, to guide piles and to chain moorings. The holes which they were to occupy in the river had been dredged out and made level, but on the first occasion of sinking the first caisson, which was done by letting in the water through a sluice after the first course of the foundations in stone had been laid in the vessel, it was found that the levelling (Lahelye calls it "digging,") had not continued level, and that some ground at the sides had fallen in. The hole, or "pit," as it is termed by Lahelye, was about 6 feet deep and 5 feet wider than the caisson all round, and sloped off at the sides. The water was thereupon pumped out and the caisson rose, the defective bottom was redredged, and the caisson was sunk a second time, when it bedded itself perfectly level.

The caissons were 80 feet long and the widest about 30 feet wide, they were of fir, the bottoms were framed, and they rested on sole pieces, as we should term them, which projected below the bottom level of the framing about 6 or 8 inches. I imagine it was presumed that this sole piece would cut itself a channel, but it would seem it did not always do so, for in a part of the old caisson bottom which has been taken up and is now on the stage at the Westminster Bridge works, the cross bearers have considerably sunk, and indeed as the bottom was gravel or ballast, it would probably be firm enough to resist the indentation of the sole piece, and there would be a hollow under the entire platform. By the kindness of Mr. Page, the engineer to the new Westminster Bridge, I am able to put on the table a part of the sole piece of this caisson bottom, and must draw your attention to the thoroughly sound state of preservation in which it is found. Each caisson contained, according to Lahelye, "150 loads of timber, or as much as a 40-gun frigate of that day," but certainly not so much as a frigate of that size at the present time.

The difficulty in the construction of these foundations, even supposing them to have had a sufficient substratum and one not liable to be scoured away, was to dredge and maintain a level in ballast. So great was this difficulty found that piles of square fir, 7 feet apart, were driven down to a depth of about 13 feet below the surface of the bed of the river, at a considerable distance from the holes and all round them. These piles had grooves in their sides in which boards were placed and cleated down under water to a height of 2 feet above the bed of the river, to prevent the silt from being carried into the holes.

The foundations for this bridge quickly gave way, indeed during its construction two arches had to be removed and re-built, and Mr. Walker, the engineer, states in his evidence that the caissons sunk in the middle, and the sides and ends which projected beyond the stone work broke off and were twisted up. Mr. Walker attributes these defects to the want of sufficient original area in the holes for the caissons, and to the fact that the holes were probably hollow in the centre when the caissons were deposited; but it would appear that the sinking of the very bearing area of the substratum under the partial and unequal pressures of the caissons has had more to do with the failure than any other defect, for notwithstanding the sheet piling which was driven round the piles at a distance of 6 feet, and the inclosure by this means of some of the piers so that no scouring could take place, they have since sunk, and this after the removal of between 20 and 30,000 tons by alterations of the superstructure.

Blackfriars Bridge was built by Robert Mylne, in 1760 to 1771, it consists of nine semi-elliptical

arches in Portland stone, the largest of which is 100 feet span, with a rise of 41 feet. The piers are about 27 feet 6 inches wide at their foundations. This was the first introduction of the elliptical arch into this country.

The foundations for this bridge were also laid in caissons, but the holes in which the caissons were placed had piles driven into them about 9 feet apart each way, placed probably more with a view to preparing an even surface for the caisson bottom than for support, since they were very shallow and there were only forty-five to each pier. The heads of these piles were cut off under water. In their evidence before a Committee of the House of Commons Mr. Rennie and Mr. Walker attribute the stability of this bridge to these piles. Sheet piling, but of no great depth, were also driven round the out-sides of the caisson bottoms.

The foundations of this bridge also settled not long after the removal of Old London Bridge had occasioned the increased scour, which took place in the above-bridge bed of the river, and they were subjected to repairs by Messrs. Walker and Burgess, which resulted, as at Westminster Bridge, in the expenditure of large sums of money uselessly. Sheet piling was driven round the piers and caisson bottoms, the intermediate space was filled in with concrete, and a stone pavement carried on the top of it to the lower course of the foundations. These repairs to both bridges, by Messrs. Walker and Burgess, seem to have been based upon the experience of starlings at London Bridge and elsewhere. They seem to have believed that if the scour could be prevented, and nothing carried from under the foundations by external agency, the clay would support the gravel, and the gravel the stone; but the pressure upon each square foot of these foundations was, in Westminster nearly 5½ tons, and at Blackfriars probably 5 tons per square foot, and clay under the most favourable circumstances, when the pressure is at great depths within it and the mass has been in no way disturbed, will not bear so much as 5 tons per square foot pressure. The sheet piling driven round these piers broke the homogeneous mass of the clay, and converted the portion which it inclosed into a square block of compressible material, which as might have been foreseen had due examination been made, the superincumbent pressure was too much for—the piles then gave way laterally, and the object for which they were inserted was not even attained. Now in Old London Bridge the original piling was never disturbed: the true bearing of the piles, though they existed only at the out-sides of the foundations, was sufficient, and the starlings, sheet piling, and filling in were only adjuncts to the strength, and were necessary only on account of the extra weight in width, and the structures upon the bridge which were added from time to time. I beg to draw your attention to a small drawing of a pier of old London Bridge, which was removed to make a water way during the construction of the new bridge, and which shews the original bridge on piles, which though only round the outside of the pier were so placed as to carry the whole weight, and the extent of surface to which the starlings and extensions of the pons were carried. These piles when drawn were as sound as when put down; portions of them are now in the possession of more than one architect and engineer, and though upwards of six hundred years old they are convincing proof of the permanence of pile foundations, when thoroughly embedded in the earth.

Waterloo and London Bridges, which were both built by John Rennie, have both the same kind of foundations. Waterloo Bridge, built in 1800 to 1817, has nine equal semi-elliptical arches of 120 feet span and 35 feet rise; and London Bridge, built in 1825 to 1831, has five semi-elliptical arches, two of which are 130 feet span, two 140 feet span, and the centre arch 152 ft. 6 inches span, with 37 feet 6 inches rise; it is 52 feet wide, none of the other bridges, including Waterloo, being more than 45 feet wide. The foundations of both these bridges were constructed in coffer dams. Into the construction of coffer dams it is not now proposed to enter, their object, their purposes, and their

details being well understood in this room. The entire area of the bases of the piers is piled with elm piles, about 20 feet long and about 3 feet apart, and which penetrate the London clay, in the case of Waterloo Bridge probably to a depth of 18 feet, and in London Bridge about 18 feet 9 inches or 19 feet. On the heads of these piles were laid sleepers, and the loose earth between their heads was replaced with rubble concrete, on which blocks of Bramley Fall stone and brickwork filled-up the spaces between the pile heads, immediately below the platform of oak planking which carried the first course of granite masonry.

The pressure upon each pile in London Bridge has been estimated at 50 tons, or about 5 tons per foot superficial on the entire area, and this is considerably below what the piles would actually carry. The difficulty of applying sufficient dead weight upon piles, to ascertain their bearing powers in equilibrium, has always prevented the formation of any formula or data on which engineers can base their experiments. The piles are driven and the pressure they must be sustaining is then calculated after the load is on, no maximum having been ascertained. At the border bridge on the Newcastle and Edinbro' Railway, the calculation shewed that each pile must be sustaining a weight of 70 tons. The pressure on each pile of Waterloo Bridge is probably somewhat less, but still it must amount to at least 68 tons.

London Bridge has a close pile sheeting all round the platform, which penetrates about one-third of the distance of the main bearing piles. Waterloo Bridge does not appear to be so protected, yet London Bridge after the removal of the coffer dams settled in every pier from 6 inches to 10 inches towards the down stream; this was attributable to the entire area of the river substrata finding their proper bearing after the disturbances to which they had been subjected by the piling of the coffer dams and of the centerings. The coffer dam above bridge was in 35 feet of water below low-water mark, and the piles were consequently very deeply driven, and though those which were near to the piers, or could apparently affect them, were not drawn but cut off, the mass of the clay had received a disturbance which settled itself probably once and for ever, and if the bearing areas and the tenacity of the piles are sufficient for the superincumbent pressure, no further settlement need be apprehended.

Southwark Bridge, also built by John Rennie, was erected in 1814 to 1817, the spans are 240 feet in the centre arch, and 210 feet each side arch. The arches are segmental in eight cast-iron ribs, and rise about 22 feet. The two piers are each 24 ft. wide, they were built in coffer dams upon piles which were about 2 feet 6 inches apart, or even closer, and 20 feet deep; the drawings which I have been enabled to examine, represent about 286 piles under each pier: the platforms for the first course of masonry were made in a similar manner to those of London and Waterloo Bridges, and no settlement has taken place as far as I can learn, nor has any repair of moment to either sub—or super—structure ever been necessary.

Vauxhall Bridge, by James Walker, was built in 1811 to 1816; it consists of nine segmental iron arches in ten ribs of equal spans of 78 feet, the rise being 11 feet. The foundations were laid in caissons, which were sunk down to the London clay, the river being dredged I believe in its entire breadth for that purpose; the footings are in stone, no subsidence has been recorded; I have not been able to learn the precise means taken to prevent the scour from undermining the caissons, but I believe that Kentish rag and ballast was thrown down around the piers in vast quantities.

Hungerford Bridge was built by I. K. Brunel in 1844; the foundations of the two piers which carry the chains, rest on a bed of gravel which is stated to be as hard as a bed of artificial concrete. No piles were used in the foundations, a coffer dam being formed round the piers, and the ground was excavated down to the hard gravel which was found about 6 feet below the then bed of the river.

Below the mud (and until the hard gravel was met with) gravel of a looser kind was encountered. On the Hungerford Market side of the bridge at the mooring piers, the ground was very bad, piles were here driven to the depth of 30 feet. Mr. Brunel terms the beds on which the bearing piers rest, two masses of hard gravel (as hard as concrete) forming a natural formation, situated in the midst of a looser soil.

Chelsea Bridge, erected by Mr. Page in 1850-1857, is a suspension bridge, the chains carrying which pass over two piers in the river, each of which is 88 feet long by 10 feet 3 inches wide, the foundations of which consist of bearing piles of elm, 13 inches square, 3 feet 6 inches apart, driven to an average depth of 32 feet below low water mark, which would probably in that situation give a depth of about 16 feet into the London clay. These piles were driven to a test which ensured their capacity for resistance to a much greater extent than their ultimate individual load could ever be. Cast iron piles 12 inches in diameter, and 25 feet long were then driven 20 feet into the ground (probably about 10 feet into the London clay), all round the bearing piles, and in grooves on their sides, cast iron plates were driven down between them, so that each pier is encased in iron, to a depth sufficient to prevent its being injured by the scour, or wearing away. The casings are filled-in with brick-work in cement, built in cross walls, and the cut-waters with solid work.

In New Westminster Bridge the same principle has been adopted, but from the importance of the work it merits a somewhat more extended description. When it was determined that the new bridge should occupy the site of the old one, but be of twice the width, Mr. Page proposed to erect one half of the bridge first and open it for traffic, before the demolition of the old bridge; and after many delays, and an interference by the Chief Commissioner of Public Works, who desired to be satisfied of the principle of construction adopted, this work is now being carried on, and presents a striking example of the progress which has been made in the economy of construction.

The bridge will have seven arches, the centre of 120 feet span, the two next it of 115 feet span, the two next them of 104 feet 6 inches, and two next the abutments of 94 feet 9 inches span. These arches will be of a curve approaching to the four-centred arch, and each will be constructed in 15 ribs of cast and wrought iron; the bridge will be 80 feet wide, the piers at the bases are 18 feet wide, and will be 110 feet long, the south or upper halves of them of 55 feet wide, are now in course of construction. Elm piles 32 feet long are driven in alternate rows of three and five each, to the number of 145 in each pier, and these piles penetrate the London clay to a depth of about 18 feet, and each is capable of resisting without motion, and many I am informed have been tested to, a bearing weight of 60 tons. Round these elm piles hollow cast iron piles, 15 inches in diameter and 25 feet long, are driven 4 feet apart, and between these in grooves cast on them, cast iron flat piles are driven to nearly the same depth. These flat casing piles are each 13 feet 6 inches by 4 feet, and they are strengthened by flanges or ribs at their backs; these piles having been carefully driven, and their direction and fit examined by means of the diving dress, the soil of the river into which they have been sent and which they enclose, is dredged or rather scooped out until the hard gravel which superlies the clay is reached, and at this level iron ties, two to each flat plate are inserted, and concrete is filled in to the level of the tops of the piles, which are cut off about 6 inches below lowest water mark. This concrete is composed of Portland cement and river ballast in the proportions of 1 to 5, with a small per centage added for waste, and is applied after the method adopted by the French in subaqueous works, by a shoot or funnel which is carried under the water, and which is moveable to allow the concrete to be spread without too great dilution. Embedded in the concrete and resting on the top flange of the flat piles, is a granite casing 1 foot 8 inches thick, and on the heads of the elm bearing piles is a course of Bramley Fall stones, covering the heads of two or three piles alternately, upon this the bottom course of granite which is in stone of large bearing, is laid with a projection over the face of the outside piling

so as to be a fender to them; a second course, the plinth course of granite, is also carried through the pier, as are also a bonding course midway, and the top course of the same material which carries the bed plates for the iron girders. Indeed from the quantity of granite used in each pier, the brick-work is mere filling-in, and the piers must be said to be granite and brick, and not merely brick faced with granite. Outside the pier the loose bottom and the gravel bed are dredged away to the clay, and concrete is to be inserted to a width of about 6 feet.

After this description of the different foundations of the piers of the bridges which are in existence in the river Thames, it will be seen that the conclusions which must be drawn from the practical experience of those foundations which have failed, and those which have not, are very limited, but they are at the same time very clear and simple; the bed of the river Thames is much lower than when the bridges which have failed were built, a fact occasioned by the increased scour produced by the removal of the dam which old London Bridge afforded, the contraction of the waterway by the projection of embankments, and though last not least, the ballasting which for a long period constantly proceeded above the bridges, and though now to a great extent prevented, yet sufficient from the dredging operations as well below as above bridge to deepen portions of the water-way by some inches annually. This deficiency is not made up again by the deposit of gravel or ballast, for the deposit of the Thames is silt, sand, and mud; and the original gravel bed of the Thames has been so reduced by dredging, and by the scour consequent on changes in the water-ways, as to be now only existing in sufficient thickness to be built on in cases as they were termed by Mr. Brunel, such as the parts on which the Hungerford bridge piers were constructed. Wherever, therefore, we find the foundations have been made to depend on the gravel, and have not been taken deep into the London clay, failure has taken place. The piers of Hungerford Bridge, the only exceptions to this rule, are so lightly weighted and situated so fortunately for avoiding scour, and have been so recently constructed, that they cannot be said to disprove it. The rule of experience is, that in the clay only can a sure foundation be found, and no casings have yet been added to defective piers which have held the enclosed gravel into a sufficiently compact mass to prevent its sinking by loss of substance through the joints of pilings. Down to the clay then we must go for a sure foundation, and the different methods of effecting this are the only points for discussion.

The old successful examples in London are all of one class, they are cofferdam examples with the exception of Vauxhall Bridge and the new bridges designed by Mr. Page. Vauxhall Bridge, as has been shown, was a caisson foundation carried to the London clay without piling, and the weight of the bridge is not sufficient to need piling. All the other sound bridges are piled deep into the blue clay. The shoulders and sides of these piles, and the surface of the clay between them at their tops, are the ultimate bearing points upon which presses the superstructure, whether of granite or stone courses, or of compound concrete and wood, or of iron. Theory would say, upon this foundation make the superstructure as light as is consistent with even pressure and avoidance of jarring which may cause motion, every pound you place on the shoulders of the piles, or upon the earth's surface at their heads beyond what is required for inertium is useless and superfluous. To maintain the piers in perfect inertium, and immovable under the pressure of water, floating ice, or drifting sailing barges, or unskillfully directed steam-boats, and the heavy road traffic over the bridge, requires a much less weight than would result in an equilibrium between the bearing surfaces and the pressure; it is not necessary to have solid granite from the bearing points to the voussoirs for equilibrium, and almost any materials that can be used are in the tidal currents of our river sufficient for this purpose. It is perfectly true that London and Waterloo Bridges would be absolutely stronger constructions theoretically, if their piers were not so enormously heavy, and were built of brickwork, or hollow.

The objections which have been made to the foundations for the new bridges designed by Mr. Page, of which experience has not yet been had, are resolved if these views be admitted into the question whether the bearing points of his piers are in the London clay, whether there is a sufficiency of resistance within that clay, and whether the superstructure of the piers is sufficiently strong to be always in inertium.

With regard to Westminster Bridge, after a careful examination, I must express my belief that these points are amply provided for. The bearing weight upon each pier cannot be more than 2000 tons according to my estimate, the 133 elm bearing piles in each pier, therefore, omitting the cutwater piles, will not have a pressure of above 15 tons upon each, supposing the load equally distributed, and that no assistance is derived from the intermediate clay, but as is proved in the case of London Bridge where the piles are not deeper nor larger, they could have 50 tons without deflexion, we may omit therefore the intermediate clay with its compressed and confined natural gravel surface, and the concrete over it; but we must be sure that the piles will be maintained perpendicular within one fourth as true as they would be if in a similar case to those of London Bridge, they had been driven down into London clay for their entire length. The concrete and the iron casing I believe to be ten times a stronger medium for the retention of the piles in their places than the London clay at whatever depth would be, and I omit therefore all aid from the external piles and casing in bearing the weight, and find that the 133 elm bearing piles are alone capable of bearing, if all equally taking the superincumbent pressure, a load four times as great as can ever be upon them, and this leaves ample margin for unequal bearing, supposing any to occur; great precautions are taken against this however, and there is not so much occasion to apprehend it as with cross sleepers and bearing planks such as exist at the successful bridges.

With reference to the superincumbent pier, I confess that the solid granite courses which Mr. Page, at the suggestion I believe of Mr. Stephenson has inserted, are better for the purpose of immobility of the pier from external influences, besides the dead weight it has to carry, than the system of brick cross walls and arches that he originally designed, though these were, I dare say, sufficient for the purpose; and, therefore, looking only to the elm bearing piles and the brick and granite superstructure, without reference to the external plate and fender piling, I believe Mr. Page's piers to come within the conclusions of success which may be derived from experience in the Thames.

Now, with regard to the destruction of the foundations of piers in the river by scour, I think the ultimate depth of the scour will never under any possible circumstances extend sufficiently far down the piles of either London, Southwark, Waterloo, or New Westminster bridges, to cause any apprehension on this score, and simply renewing the casing and filling round the piers with concrete will be enough to prevent their injury, should a tendency to scour be observed. The river has deepened only in places for some long time since its great deepening by the removal of London Bridge. When embankments are carried through on each side, as we must all hope they will be, and the channel narrowed, the equalization of the depth will at that time prevent any serious increase of scour.

The methods proposed to counteract this effect by Mr. Cubitt and Mr. Hosking, would also prove effective to preserve bridges founded so deep as those piled into the London clay, though they would not probably have preserved either Westminster or Blackfriars. Mr. Cubitt proposed to pave the bed of the river with stones for a distance above and below the bridge of some 60 feet I believe, as well as under the arches, and Mr. Hosking proposed a sub-weir of piles across the river to a height which should prevent the rush of water degrading the existing bottom of the river, and he showed that ample water would remain at low tide to answer every purpose of the navigation.

Le Crenit, chief of the French Pouts et Chausseés in 1780, in his work on rivers proves that the beds of rivers do not change sensibly when considered throughout their course, but that local causes alone occasion increase or decrease of depth in the beds in different places, and not throughout their length, and the Thames being subject to no violent floods, and having on the whole very steady tides, it is not probable that unforeseen and unpreventible injury should occur to deep-seated foundations well protected in its bottom.

The inquiry into this subject has led me to seek information as to any failures from scour which have occurred to bridges abroad, and I cannot find an instance of a deep-piled bridge which has fallen, many have needed repair, and most of them have of late been strengthened by throwing in concrete round the piles, and no question seems ever made of the stability of this enclosing medium, or of its tenacity to the wood piles. Indeed, the employment of concrete by the French in hydraulic works is far in advance of our application of it hitherto. They do not scruple to use it without any encasement whatever in the beds of swift rivers subject to violent torrents during floods.

Upon the subject of the durability of the encasements of the piers at Westminster and Chelsea bridges there exists some difference of opinion; for myself, I think that if the hollow piles are filled with cement grout, they will, as respects the buried portions of them, be almost as durable as the other portions of the structure, and will be as compared with past constructions, whether Pelasgian, Grecian, or Roman, indestructible; but as respects the portions out of the clay, unless some preservative is applied to them, they will not endure probably more than three hundred years. It was Mr. Hawkshaw I believe, however, in his evidence before the Committee of the House of Commons on this point, who said that by the time that any decay of moment had occurred to the iron casing, the condition of the other portions of the structure would be so stable as to admit of its removal and replacement without danger, and when we consider what has been done both at Blackfriars and Westminster in the way of cutting at the old foundations, I have little doubt that these piers could be with care re-encased without any danger to the foundations, which it must be always remembered is deeper than the pile casings, and not above them, as was the case at those defective bridges. Screw piles might at any time be placed a short distance outside them without any risk from vibration or concussion in the strata.

The use of the diving-bell and diver's dress is much contributing to the efficient performance of these works at Westminster Bridge. These inventions are, however, quite in their infancy, and there is little doubt that so great improvements will be made in them, as to enable sight as well as touch to be used at greater depths than now. They are not however essentials to the proper driving of iron piling. At the foundations for the Gravesend pier which were composed of piles 15 inches in diameter, which required to be driven at triangular points with the greatest nicety to a depth of 10 feet into the chalk, a harder medium than the blue clay, not more than six out of fifty-four piles required chipping, and the greatest variation did not exceed $\frac{1}{4}$ of an inch.

Into the subject of the abutments of the bridges we have not time now to enter, nor are the conditions similar, or the methods of founding them so different and peculiar as to require separate notice. Nor do I now propose to examine into the question of the building of the foundations of the New Westminster Bridge in two halves at separate times. I am of opinion that the first few piles next the half of the piers which have been built should be screwed in and not driven, and then there will be no risk to the work, but bearing in mind the settlement in the pier of the old bridge repaired by Mr. Walker, and which carried down not only the old pier but the new work also, and the settlement at London Bridge, I should fear any disturbance, however slight, in the London clay—not that danger is to be apprehended, but such a settlement as occurred at London Bridge after

the removal of the coffer dams might, I think, occur, and after the energy and perseverance which has been displayed by the engineer to this bridge, any such untoward accident could not but be a subject of great regret to all independent professional men who sympathise with the interference with this great work which was occasioned, not only by the Chief Commissioner, but by practical men, whose knowledge of the consequences of the experiments already made in the Thames might have led them to show greater consideration.

Mr. MATTHEWS, Associate, said he was exceedingly glad that such a practical subject had been brought forward; for it was too much the idea out of doors that the Institute was a Dilettanti society, or at the most, that it represented and taught architecture as a fine art only. He regarded the architect as the father of the engineer, both military and civil. In former days the architect was certainly a military engineer—San Michele was inventor of the bastion system. Architects had also frequently been successful bridge builders. Indeed, both as a man of science and taste the bridge is peculiarly within his province. Mr. Boulnois had treated the subject not merely as an architect, but as an engineer. He (Mr. Matthews) had extracted from Mr. Page's report on the foundation of Westminster Bridge, some of the data as to the weights and loads to which piling had been subjected in dock work and bridge foundations, and he found that at Hull Docks the piles were 10 in. diameter, carrying a weight of 37 tons per foot super. At London Bridge the piles were 10 in. diameter, and carried a weight of 80 tons per foot; at the Albert Docks, Liverpool, the piles sustained a weight of 80 tons per foot; whilst at the new bridge at Westminster, the piles would be 14 in., and they would only have to carry 12 tons per foot. Mr. Page stated that elm piles, such as those used in the foundations of Westminster Bridge would carry 200 tons each without permanent deflection, and the facts referred to appeared to bear out the figures given by Mr. Boulnois. With regard to the piles of Old London Bridge, he (Mr. Matthews) rather more than a year ago, had had occasion to go down to them, some 30 feet under high water mark, at a time when a large warehouse was being built on cast iron piling and sheathing. The piling of the old bridge was reached in sinking a shaft which became necessary in consequence of the snapping of the iron piling of the warehouse, and they were found to be as perfect and as sound as the day they were driven.

Mr. M. D. WYATT, Hon. Sec., asked if the piles were entirely embedded in the clay, and not exposed to either water or air.

Mr. MATTHEWS said they were in the clay, and 10 feet below low-water mark. Oak and elm appeared to have been used indiscriminately.

Mr. JENNINGS, Fellow, felt great doubt as to whether piling was altogether the best system that could be adopted for bridge foundations. The bed of gravel which covered the London clay, if it was of sufficient thickness, formed the best foundation that could be had; and it appeared to him somewhat doubtful whether it would not be the wiser plan, when that natural bed of gravel did not exist, to spread an artificial bed of gravel over the clay to form as large a base as would suffice for the purpose; or again, whether a concrete foundation would not be better than any system of piling. In his own experiences of concrete foundations he had found that Roman cement answered the purpose more perfectly than Portland cement. The piles which he had examined in connection with the River Thames appeared to have stood well, though partially exposed, and those which he had drawn had been in the ground only sixty or seventy years, and were made of round timber; but whether piles stood better round than square he had no means of judging. As illustrating the failure of some of the London bridges the case of the Victoria Docks might be mentioned. It was there found that the London clay was unable to resist the lateral pressure, and although the pressure might have been

unequal, still the fact that piles would move at all in such a situation, shewed that they did not form a perfectly good foundation. He thought if there had been a larger portion of concrete the piles referred to would not have given way (as they had) entirely from lateral pressure. With regard to the alleged waste of money on the foundations of Blackfriars' Bridge, Mr. Walker had told him that the amount was not more than a year and a half interest on the sum which it would cost to rebuild the bridge; and if so, the money could hardly be said to have been wasted. Mr. Jennings further referred to the tendency of piles, shod with iron and pointed, to sink gradually into the London clay, and thought that screw piles with flanges would have very little of this tendency.

Mr. M. D. WYATT, Hon. Sec., observed that piles might be placed in three different positions, which would furnish corresponding sources of durability or decay. They might be driven entirely into and covered by the clay or other soil; or they might be partly in clay and partly exposed to water, or they might be partly in clay and in water, and be exposed by variable tides or evaporation to the atmosphere also. A pile being driven from the head, the wood became compressed, but by the action of water the fibre swelled again; and if alternately exposed to drying and being wetted, the fibre of the wood by alternate swelling and shrinking became disintegrated and the pile would rot; but when a pile could be completely driven into the clay its duration was indefinite. Although the strength of piles to resist vertical pressure chiefly depended upon the material in which they were driven pressing equally against their sides, still to a considerable extent, a pile shod with a sharp point would act as a wedge, and would not bear the same weight as it would if the end were more spread, though, of course, in the latter case, the difficulty of driving it was increased. M. Viollet le Duc, in his work on Mediaeval Architecture, had shown that the best piles had rough points, with the ends charred; thus in the action of driving them they at first entered the soil readily, but, as the blows continued, the end of the pile spread, and getting a better hold of the soil, ceased to act as a wedge, and became more stable than if any other form had been used. It was a well known fact that the durability of timber was immensely increased by undergoing any change, such as that which the bog oak of Ireland had undergone. This was almost as hard as flint, and its existence dated from quite an indefinite period. In Venice it was found that when the piles had been driven down to the level of the soil, and when their heads had been cut off in the water to receive a planking of flat boards (the piles being exposed to the action of the earth, and scarcely to that of the water) they had stood very well, as was shown at the Cathedral of Murano and other old buildings; but in the modern buildings, where sheet piling was used, and where the piles were partly exposed to earth, water and air, they had been found to give way.

Mr. PENROSE observed that a great deal of trouble had been caused for many years by the washing away of the starlings of old London Bridge, in consequence of the scour of the river. The old gateways on the bridge were pulled down, and their materials thrown down to repair the starlings. He believed it was stated in Domesday Book that the piles under these starlings had not been always entirely under water, and that the fishes had swam in and out from under them; but as these piles were found to be perfectly sound, this would not appear to carry out Mr. Wyatt's view.

Mr. C. BARRY said that few questions could be more important than that of the destructibility or indestructibility of timber for sub-foundations, and as facts were worth more than any theory, he might mention the case of a heavy building in London, 120 years old, which was built in a boggy soil. Elm piles had first been driven, without much force being required, and on these there was an elm planking upon which the walls of the house were built. These walls were carried sufficiently below the surface to apparently protect the timber entirely from air; and upon examination the timbers were found, excepting in one or two instances, to be perfectly sound. Where there were any decayed he

was inclined to attribute it to the timber having been used in too green a state, but where it had been originally sound, well grown and mature, it was found in a very good state, the arrises complete, and the surface as entire as when it had been laid down. The mortar joints of the lowest course of brick-work were plainly discernible. This was an illustration of the indestructibility of piling used in earth the surface of which was more or less a sponge, and which must have been completely saturated with water; and therefore if water would have any effect it must have had it in this case.

A MEMBER said that he knew of a case of a similar kind at the East end of London, where an old shop was built upon oak piles and planking, where the timbers were sound, but the walls of the building, which was a heavy one, were in a state of considerable danger.

Mr. M. D. WYATT. The safety of piles in earth depends upon their being entirely covered, and not exposed to a variable action, and clay was the best of all covering materials for durability.

Another MEMBER mentioned the case of a large building close to the river, built about a century ago, apparently on elm planking. The soil was always wet, and the building had settled in every direction. The timbers were found perfectly rotten, and it was necessary to substitute concrete for them.

Mr. JENNINGS observed that where timber was merely subjected to damp, without being really under water, it always decayed. About Piccadilly many houses were originally built on planking. An improved system of drainage took the water to a lower level, and the houses had to be underpinned, but the planking still stood.

Mr. HAYWOOD, Fellow, stated that the line of the river Thames was formerly 30 or 40 feet north of the present line of Thames Street; and that in excavating in the neighbourhood, the piles forming the facing of the original line of wharfs were found to be substantially sound, whether above or below high water mark. These piles were occasionally of oak, but more frequently of elm, and many of them must have been buried beneath the soil from 200 to 400 years, the soil being at all times so very wet that by digging only five or six feet a pool of water was found.

Mr. M. D. WYATT suggested that it might be possible that woods containing resins that were not soluble in water, might be most durable; and if so, that timber employed for these purposes should be used when it was full of these resinous saps, and should be immersed in water so that they could not evaporate. In Ireland there was a peculiar class of monuments, namely, the old residences or rude castles in the midst of lakes, which were held by the native chieftains before and during the English invasion. These were formed by driving piles into the bed of the lake in the shape of a ring, and then bringing soil from the banks of the lake and filling up the ring; many of the castles so constructed dated from the year of the Conquest; they had been investigated recently by the engineers engaged on the Ordnance Survey of Ireland, and the piles had been found in a very perfect condition.

Mr. JENNINGS observed, that if the lakes referred to were impregnated with bog water that circumstance would tend to make the piles more durable.

Mr. WYATT concurred. The bog water was of an antiseptic nature, and would destroy the action of insects, as well as prevent the general decay of the wood.

Mr. JENNINGS said that a very large portion of London was built on beds of bog, from six to eight inches thick, which would have a considerable effect in preserving timber.

Mr. WYATT. Those patches of bog might themselves be the product of decayed wood.

Mr. C. H. SMITH, Honorary Member, said that he was not aware of any effect which moisture could have upon pure resin; and it was well known that the preservative effect of the turpentine contained in yellow deal was much greater than that of any bog water could be. Some years ago he

had examined a large house in Yorkshire, belonging to Lord Down (erected by Sir John Vanburgh), and the walls of which had cracked in a variety of places, from top to bottom, although originally of great strength. This building had been constructed entirely upon planking, either with or without piles. This planking was from three to five inches thick, and there was a great deal of fir timber in it, and where the timber had a quantity of resin in it, it was not affected by damp, and the walls were sound; but where there was no resin in the planking it had decayed and become compressed, and in some places was not more than an inch and a half thick, which was quite sufficient to account for the sinking and cracking of the walls. He understood that a deceased architect formerly connected with this Institute had advised Lord Down to wait till all the timber planking had decayed; but he (Mr. Smith) thought it would be a very long time indeed before that decay enabled the building to resume its original level.

A MEMBER thought that it was very desirable to get rid of the timber platform, which seemed to be the real source of decay, and if possible, to lay a foundation of concrete upon the piles themselves.

MR. WYATT said the great thing in bridge building was to get rid of the outer piles which rose into the water, and which presented faces which were acted upon by every change of current, thereby disturbing the solidity of the clay in which they were embedded.

MR. BOULNOIS in reply to Mr. Jennings's remark on the superiority of concrete to piling, observed that unless a superficial area could be obtained, such as would involve a very great encroachment on the water way, no concrete or other material could be made sufficiently resistant to carry the superincumbent weight. The London clay would compress at five tons per square foot, and concrete without piling must extend over an area of water-way which would never be permitted. The failure at the Victoria Docks was an exemplification of the necessity of maintaining the London clay in its original position, without any interference by piling or driving in its adjacent neighbourhood. [Mr. Boulnois made and explained an illustrative sketch.] The case referred to by Mr. Matthews, in which iron piles had snapped, shewed the difficulty of dealing with them, as they were far more likely than wooden piles to break on coming into contact with nodules in the clay. He agreed with Mr. Jennings that Roman cement would set quicker and be apparently harder than Portland cement, but when the former became broken or destroyed, any stones which had hard surfaces and were not porous would come out of it like eggs, whereas in Portland cement he thought the contact with smooth stones was much more perfect. If none but porous stones were used the Roman was as good as the Portland cement. Mr. Boulnois referred to the items of the expence incurred in repairing Westminster Bridge and Blackfriars Bridge, which he thought shewed that Mr. Walker had greatly understated the matter, in saying it was only a year and a half's interest on the cost of re-erection. The circumstance mentioned by Mr. Lewis was very singular, and had very often puzzled people who had to deal with waterside premises. It seemed that although the water was always there, there were different degrees of water, and air, and the water was not in sufficient quantity to exclude the oxygen, the timber being simply damp, and not entirely submerged. The fact stated by Mr. Hayward as to the river having formerly risen up towards St. Paul's was curious, and it would be desirable, if possible to have further particulars on the subject. In conclusion, Mr. Boulnois expressed his thanks for the interest which had been shewn on the subject of his paper.

The Chairman (MR. GILBERT SCOTT, V.P.) said, there could be no question whatever, that on a clay foundation, like the bed of the Thames, piles were better than any other method. When we consider the enormous force required to drive piles 30 feet into the bed of the river, it appeared almost self-evident that the weight they would bear would be greater than that of the stratum into which they are driven, and by scientific experiment it is proved that whilst the clay itself would only bear a

pressure of five tons per foot, these piles would carry from seventy to eighty; therefore, on this point there could be no doubt as to the use of piles, or their ability to bear the weight, if the piles were durable, which they must be under the bed of the river. The real boldness of Mr. Page's experiment at New Westminster Bridge (and he was entitled to great credit for the attempt), was to build not merely on the tops of piles, but upon a pier formed of piles rising through the water, and almost to its surface. The reasons which had been given seemed to give every reason to hope that the plan would answer, but it was an extremely bold experiment. There was no reason why piles should decay at six inches under low water mark, any more than if they were thirty feet below it; nor was there any reason why they should sink deeper because they were longer than usual. The only question was, whether there was any danger of their moving laterally, together with the sheet piling of iron, and the immense mass of solid concrete between them. The look of that mass of concrete, and of the entire plan, seemed to give every possible reason to feel confidence in the theory involved, and in the stability of the structure. If it succeeded, Mr. Page would have established a new system of bridge building which would be safe and practicable without the use of coffer dams. As architects however (admitting that engineers had taken bridge building to a great extent out of their hands), they were more interested in the abutments of bridges and in water-side buildings, and with regard to these the question remained unsettled whether concrete or piling formed the best foundation; many instances having been cited to shew that in some cases piles had stood thoroughly well, and in others that they had not. He had been engaged with Mr. Roberts when the present Fishmongers' Hall was built, and there the immediate foundation was concrete, on a bed of muddy peat, in which there were a great number of old piles. These piles were almost entirely of oak, and they were in such a high state of preservation that the breakage of the grain from the force with which they had been driven was quite distinct; and on cutting the head of one of them it was found unaltered in colour and hardness. It had in fact, a nice fresh yellow colour just like a new piece of wainscot. This was probably partly the effect of the peat, which had preserved grass, nut-shells, &c., in excellent preservation. At Hackney Church, far away from the river, the tower was found to be sinking considerably, and it was found that this building had stood below the level of some land springs which had been carried off by an increased depth of drainage, leaving the foundations dry. On examining the foundations, a black line, about a quarter of an inch thick, was found in the course of bricks above the footings, and this proved to be the remains of a three-inch deal planking, which had been continued all through the thickness of the walls. The knots in the timber all remained probably from containing more resin than the other parts, and had been crushed up into the next course of brickwork, thus corroborating Mr. Wyatt's view of the value of resin as a conservative agent. An oak sleeper in the middle of the wall was also very much decayed. These cases appeared to shew that in a dry foundation neither oak nor deal could be expected to last long (the work referred to was not fifty years old); whereas in a wet and peaty foundation, oak would last almost for ever. But even taking it for granted that piling could not be successfully used, it would appear that concrete was just as much liable to failure and decay. Half the concrete used was perfectly inefficient against damp, and whilst the grey chalk lime commonly used was totally untrustworthy, he was equally convinced that blue lias lime was trustworthy. The use of gravel which was not perfectly clean was another cause of decay in concrete. Mr. Scott then referred to the use of trass (a volcanic stone from the Rhine) in combination with the best hydraulic limes as a concrete for foundations. He described from his own observation in Holland, the great pains which were taken in mixing these materials, and stated that the hardness of the mass was prodigious. He had brought some of this material home, and the result of comparative experiments which he had made shewed that, after being four months under water, the mixture of trass and lime

had become as hard as stone, whilst the common concrete had utterly perished. He therefore thought this material might be advantageously used for concrete.

A vote of thanks was given to Mr. Boulnois, and the meeting adjourned.

After the close of the discussion, Mr. BLACKETT exhibited a model, showing the application of his patent lock to fire-proof safes, and other depositories for valuables, and explained the principle of his invention. The novelty claimed in the patent appeared to be, the removal of the lock altogether from sight by placing it at the back of the safe instead of the front as usual; thereby preventing the application of reflectors, tools, levers, or other implements of lock picking, and altogether baffling the attempts of the most ingenious workmen to get access to it. The key was made with a handle equal in length to the depth of the safe, in which it was retained in a groove, admitting only of sufficient withdrawal to allow the wards, which were made separate from the handle, to be dropped into a portion of it with which they corresponded. The bolt securing the front door of the safe was then on turning the handle with the wards attached to it thrown from the lock at the back by a simple over-head action. Mr. Blackett was complimented by the members, who paid attention to his explanation on the ingenuity and probable usefulness of his invention.

A BRIEF ACCOUNT OF SOME EXPERIMENTS UPON CONCRETE MADE, IN CHIEF PART EXPRESSLY FOR THE COMMITTEE OF THE ARCHITECTURAL PUBLICATION SOCIETY.

By T. H. LEWIS, Fellow.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, December 14, 1857.

THE experiments here described were made chiefly with a view of verifying some facts mentioned in the description of "Concrete" in the Dictionary of the Architectural Publication Society; but I have incorporated with them the results of some other experiments previously made by me.

The general idea with respect to this material, is, 1st, that there is a sensible loss in bulk of the ballast, independently of that of the lime; and, 2ndly, that the materials, after being mixed together expand considerably. So much is this idea prevalent, that a respectable builder, one, I am sure, quite above stating anything that he did not believe to be true, required, in calculating the price of the concrete, that I should allow him one-seventh more ballast than the concrete cubed to; he depending on the published statements of the loss of ballast being thus great. It was this demand that first led me to make experiments.

The following trials were all made in the same manner; and, with one exception, I was present at the whole process from beginning to end. Several of the Committee of the Architectural Publication Society also attended at the trials. A wooden box was made holding exactly one cubic yard. This was filled with a fair sample of the ordinary Thames ballast, such as is used for concrete in London. To this was added ground Medway grey-stone lime, in the proportion of one of lime to six of ballast. The whole was then turned out and mixed together in the ordinary way, the cubic yard taking about forty gallons of water. The whole bulk would thus stand as follows:

Ballast	27 feet cube
Lime . . . 4½ }	10½ do.
Water 6 }	
TOTAL	37½

The concrete, thus mixed, was thrown into the box from the level of the ground, so that the lower part would have a fall of about 40, and the upper part one foot. The experiment was also made of throwing it in from a platform 10·0 above the ground. In each case the result was the same, viz. that the whole mass, made into concrete, occupied precisely the same space as the dry ballast, viz. one cubic yard, all the bulk of the limo and water (being about two-fifths of that of the ballast) being lost, but none of the ballast itself. The surface was carefully levelled and thin boards tacked over so as to ascertain if there were any expansion in the setting, but none could be perceived.

The weight of the mass was 27 cwt.

I then had some more ballast mixed with a similar proportion of unground lime, broken into small pieces and wetted for a quarter of an hour. It was in that time pretty well slacked, but there must have been a good deal in the centre of the lumps not slacked. We know from every day experience of the blistering of plastering in internal work that a very long time is required to slack lime thoroughly, and I thought that as this operation must be going on to some extent after the concrete had been mixed and put into the box, a sensible expansion would take place. This however certainly

did not, for not the slightest increase of bulk was perceptible. I had the first tried portion (mixed with ground lime) broken up about a week after it was made. The parts immediately below the surface, and all underneath them, had not set, but the whole formed a compact mass, without any vacuities whatever, the upper parts seeming to be as solid as the lower—though the difference in the fall was 3-0. A portion of it I put into water; I examined it in a fortnight, but it had not then set; I am sorry to say that I omitted to look at it again for a considerable time, so that I cannot speak as to the exact time of its setting; but when I took it out of the water seven months after, it was quite hard. I mention this in order to shew that the concrete was at least a good average sample. In order to try the matter more in detail, I had a box filled with very clean sand, such as is used by masons. The box was then well shaken, and the sand settled down, so as to lose about one-fifth of its bulk; the box was then filled up, so that in fact it was made to hold about one-fifth more than its ordinary quantum of sand. This was turned out and mixed well with water; after this it filled the box; but, on being shaken, subsided down to the same level as before, thus losing, in addition to the bulk of water, one-fifth of its own bulk as before. This wet sand was then mixed with one-third of its bulk of ground lime and made into mortar, which just filled the box. The surface was levelled and carefully tested during the setting, but neither expansion nor contraction could be perceived.

Another experiment was then tried at the suggestion of Mr. Wyatt Papworth:—A box was filled with coarse ballast and one-seventh of unground lime added to it, the lime being broken up into smaller pieces, but not very carefully, and then mixed with the ballast. Water was poured on, and the mass thrown into the box, when only partially slacked, the object being to see the effect of this process, which might be considered a tolerably fair example of what the men might do, if they had a certain portion of work to do with unground lime, without proper inspection, and careful only to get the whole done as soon as possible. The result was a slight but decided expansion. I then had another box filled with ballast which was mixed up dry with rather more than one-sixth of its bulk of ground lime; on being put into the box again, the two together occupied a rather larger space than the ballast did separately; the mass was then levelled, and about as much water poured over as would be used ordinarily; the result was, as before, a decided expansion.

One other experiment I should be glad to mention, as it is a curious one, and bears upon a part of the subject very little I think understood, viz. the setting and hardening of the concrete or mortar. A friend of mine, who is a first-rate chemist, suggested to me some time since that the addition of a carbonate to the mass would cause it to set more quickly, and for this obvious reason; that as the lime is supposed to be hardened by the absorption of carbonic acid, any substance in combination with that acid would offer to the lime its hardening medium in greater quantities than could be procured from the air in the same time. He further stated, though he could not procure me the details, that the experiment had been tried on a somewhat large scale with carbonate of soda mixed with concrete, used under water, and with complete success. I therefore had some more concrete made, and mixed with carbonate of soda, as directed. It was put into water, and in sixteen days was firmly set. Similar concrete, but without the soda, was not set at that time. I tried some mortar made in the ordinary way, and some also mixed with carbonate of soda, but in a larger proportion than with the concrete. This experiment was, however, not encouraging, as the mortar in setting crumbled to pieces.

I think that this artificial hardening might, as the process is a cheap one, be further experimented on with advantage.

ON COLOUR AS APPLIED TO ARCHITECTURE.

By GEORGE ATCHISON, JUN., B.A., Architect.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, Dec. 14th, 1857.

THIRTY years ago it would have been necessary to establish a continuous series of proofs, from the red cheeked ships of Homer to the painted ceilings of Hampton Court or Whitehall, to obtain a hearing on the subject of colour when applied to Architecture. Indeed a very few years since people could with difficulty be brought to listen with patience to any account of that which they firmly believed never existed; and if a few, more learned or more credulous than the rest, lent an ear to some antiquary's account of the traces of painting on a building, they made up for their forced belief by setting down all ages in which Architecture had been coloured as barbarous: nor were they to be blamed, for every tendency towards a delight in beauty of colour had been religiously rooted out, and for more than a century the very feeling was looked on as a wicked and degrading indulgence; and consequently the coloured objects which met their eyes were a sufficient excuse for calling any people barbarous who had used such decoration. At present public opinion has changed, and it would be waste of time to attempt to prove that which is allowed on all hands, that in almost every age preceding our own, buildings were painted. The question is no longer, did the Greeks and Romans, Egyptians and Moors, paint their buildings and statues, but what lessons can we learn from their painting. Was it harmonious and in good taste, or not? if it was harmonious, in what way did they produce that effect? We want them to tell us the secret of their success, not give us a pattern for imitation; so that we may hand down to posterity not a lifeless copy of the art of by-gone ages, but a new system of coloured decoration, which shall shew that we have advanced as much before them in the arts, as the discovery of the law of gravity and of the steam engine shews that we have in science and machinery. In almost every thing that serves our daily use or ministers to our luxury, we see colour more generally and more successfully applied than formerly; our figured silks and painted earthenware are frequently very pleasing, and we are beginning to rival in colour the carpets of the East; but in our buildings we seem to hang back from the general movement, and hundreds, if not thousands, of intelligent workmen are condemned to pass their lives in graining and marbling woodwork or plaster, who might be employed in painting on them the most beautiful ornaments. It may be said that these men are not artists; but the skill required to grain or marble would enable them, after a short time, to paint all sorts of ornament, if a proper cartoon, even to a small scale, were put into their hands.

In speaking of coloured decoration, I shall merely give a description of the different ways in which it has been employed in the various styles, pointing out what I think good or bad in the colour, but giving no opinion as to the style itself. I am waiting like the rest of the world for the new style that is to come; but until it does come, it appears to me that we shall not be doing wrong by making our coloured decorations as beautiful as possible, even though the originators of the style did not use colour, or used it very badly. If the forms of the decorations are good, colour will add to them an additional charm; if they are bad, colour will atone for their defects; for if colour be only good, we cannot have too much of it; if every building were most brilliantly painted, there would be plenty of relief for the eye in the mud and fog of our native land.

The history of painting, like that of nearly all the arts, is buried in oblivion; we know nothing

of its beginning, its rise, or its progress; when we know any thing about it, it is a full blown art. Between the painting of the ships of Homer and the figures on the Tomb at Veii, there must have been many steps. Homer, it is true, speaks of sculptured figures and embroidered flowers, and does not mention painting; but whether there is sufficient evidence to confirm Professor Semper's views that painting and sculpture were mere transcripts from storied tapestry, I cannot say. The diapers, zig-zags, and chevrons of early work bear a curious resemblance to the patterns in woven stuffs; but whether the resemblance is only accidental, or whether the woven pattern not only furnished them with those, but with the more elaborate Grecian frets, as Mr. Owen Jones asserts, I must leave to some one more competent than myself to determine.

As soon as nations become sufficiently civilised to attempt close imitation, their efforts are chiefly directed to the representation of men and animals, and their buildings are the blank pages on which their history, religion, and science are to be written. The problem of disposition has been easily solved by almost every people in the same way; the walls, floors, and vaults were covered with a series of oblongs or parallel lines, squares or circles, in which were placed the pictures or sculptures, and between them a space was left to prevent confusion, this space being plain, or filled with writing, ornament, or both, as the case might be: the pictures must be protected from wanton or accidental injury, and placed at such a height that they could be easily seen by large numbers of people at the same time, the requirements of the building forming arbitrary divisions. (The Jews and Mohammedans were forbidden by their religion to represent men or animals, but the ornament with which they decorated their buildings was subject to the same laws, and was treated in the same manner). The lower part of the walls was faced with marble or tiles, or hung with stuff or tapestry, painted in imitation of them, or ornamented with diapers, frets, or foliage; forming in fact a dado, usually of a darker colour than the rest of the building, to hide the dirt and stains left by the hands or clothes of the frequenters.

In applying the colours great technical skill was required: besides producing a general composition in which nothing offended the eye, and in which each part was harmonious, the artist had to use his experience in varying the tones, &c. when at a great height, separating those colours which he did not wish to blend by a white or black line, and making all in harmony with the background and in such relation to it that the whole might form a composition; without which it would have been a failure, as the background formed the largest mass of colour in the building. It is for this reason that I prefer grouping the different kinds of painting with reference to the background, instead of arranging them according to dates, or forming them into derivative groups. The grounds may be divided into *pure* and *mixed*; *pure* where the ground is entirely of one colour, which includes the gold, the blue, and the white; *mixed* where the ground is in pieces or patches of different colours. I propose to give a slight sketch of the kind of decoration used in some good example of each style; then to see what we know about colour; and afterwards to pass some of the more important examples in review, and find out whether the colouring is entirely arbitrary, or whether it appears to follow any law.

I have taken St. Mark's at Venice as the example of a gold background. The pavement is of marble mosaic, covered with all sorts of patterns, scrolls, and animals; the walls (as high as the caps of the columns) are of polished marble, principally of a dark grey, brown or red colour; the columns are either of polished marble, granite, or porphyry; the foliage of the capitals is gold on a blue or red ground, and above is the gold mosaic, which covers the whole of the walls, spandrels, soffits of the arches, vaults and domes, and on which are the subjects and ornaments. The

mosaics of St. Mark's may be roughly divided into the Byzantine of the Atrium and the Church, of about the date of 1100; those of the Baptistry of 1350; those of the Chapter House; and some scattered pieces, of the sixteenth and seventeenth centuries. The best mosaics are in that part of the Atrium at right angles to the Piazza (when I say the best, I mean as to the ornaments and the general effect of colour, but I do not attempt to criticise the pictures as works of art); the wall is filled with subjects in horizontal strips, and the vaults and domes are treated in the same way, except that the centre of each dome has generally a star or flower; the pendentives are sometimes filled with a figure or subject, and sometimes with a circle containing a portrait, with Byzantine ornament running into the angles; the ribs have figures or heads in panels with ornament between, or are entirely covered with interlacing ornament; the outer edge of the ribs is treated like a band, and ornamented with flowers or zigzags, and a zigzag pattern is generally put above the string and the cornice of the domes. The general effect is that of a pale greenish grey, without any spot standing out or grating harshly on the eye; nearly all the figures and drapery are of a pale tint, weaker in tone than the ground, and the separation of the subjects is generally effected by masses of dark produced by black writing or by dark bands. The tone of the gold, though low, is generally nearer white than black, and consequently, where great distinctness of outline is required, black lines are used, and even black and white together, to render the line more cutting; but where the outline is not required to be so very distinct, such as on light edges, Indian red is generally used, (as nothing destroys purity of colour so much as a prevalence of black lines); if the color is white, it is outlined with blue, and in very many cases a simple white edge is used. We must not confound a practice with a necessity, and though painters and mosaic-workers very frequently used a black outline it was merely from their habit of drawing an outline and then working up to it. That I might be the more certain of this, I have examined a large quantity of the gold tissues of India, and I find that by far the larger part is not outlined at all, and that when they are outlined, the darker colours only have a black, and the lighter ones a red outline.

In the Baptistry at St. Mark's, we find the ornaments of a different character from that of the other parts, the drawing being more vigorous and more Roman than Byzantine in feeling, but the colouring rather inferior; the draperies and ornaments are no longer lighter in tone than the gold ground, but are generally darker; the edges of the arch and wall ribs, the lines above the cornice of the domes, &c.—that is to say, the smaller ornamental members are generally on a black ground with a very large pattern (the main body of the rib being white); the draperies are covered with enormous diapers, and are in some cases black and white in huge patches, so that the whole effect ceases to be perfect as a composition, the white and black catching the eye: the only piece of good colouring is on a wall rib in blue and gold; the blue a very deep shade, nearly approaching a blue black, and the pattern very much resembling one of the best at Pompeii. The Renaissance mosaics are generally greatly inferior to those previously mentioned; the artists of that period though too well satisfied with themselves to learn a lesson from the old mosaics, were yet obliged to use the gold ground to make their pictures match with those around, hence deep shadows and dark back grounds could not be introduced: of the use of pale but brilliant colours they knew nothing, so they made the drapery generally deeper in tone than the gold, and got great staring masses of colour that offend the eye; while their gold mosaic gives the niches the appearance of beaten brass pans, the mosaic itself being inferior in colour, and redder in hue than the old. It is not my intention to explain the method of working in mosaic, yet as I was led to seek for the cause of the superiority of the old grounds, I may as well mention the result of my observations. In the first place, all the old Venetian mosaic is on a ground of clear glass of a deep green colour, and it very often happens that the gold leaf only

covers a part of the glass, or it covers it all over with fine lines like the fibres of a decayed leaf; but in the later gold mosaic the gold is laid on a red opaque glass, which it covers very perfectly. In the next place, each piece of the old mosaic does not exceed in size a square of $\frac{1}{4}$ inch, except when used for outlining, when a strip $\frac{1}{2}$ inch wide and from 1 to 2 inches long is sometimes used, with a small square between it and the next, and these pieces are roughly cut and irregular in size; but the sixteenth century mosaic is in great pieces of from 1 to 2 inches, cut very accurately square. The greatest difference however is in the setting; the new is laid flat and pointed in pink mortar, while the old consists of long strips stuck in at the ends, leaving a shadow all round, which has the effect of breaking the tone. In gold tissues the same effect is got by forming the woof only of gold; and in pictures on a gold ground, the ground is generally diapered so as to break up the surface. Sta. Sophia at Constantinople, and the Cappella Reale at Palermo, which are two other complete specimens of decoration on a gold ground in mosaic, are said to be finer than St. Mark's, but as I have not been fortunate enough to see them, I cannot give any opinion on the subject. A small Chapel called the Orto del Paradiso, in Sta. Prassede, at Rome, is a small but very perfect specimen. In fact there is scarcely a town of any importance throughout Italy in which some specimens of gold mosaic are not to be seen. Paintings on a gold ground in the shape of anconas, diptychs, and subjects, are very common, but I do not recollect a complete gilded background to any building in Italy; the rooms of Marie de Medicis at Paris, of the seventeenth century, are wholly painted on a gilt background, and though I recollect that it was covered with scroll ornament in prismatic colours between the pictures, and that the effect was charming, I have no sketches or memoranda to aid me in giving a description of it.

We next come to the *blue background*. Blue mosaic was also used for this purpose, but the effect is very inferior to that of the gold, as the tone of colour is very dark, and the method of setting it only adds to its gloom: the Apse of Santa Prassede is a specimen, and there are very many others, especially at Ravenna, the most striking of which is the Tomb of Galla Placidia, of the fifth century. Here the ground is a deep blue mosaic, on which are the subjects; the dome is studded with gold stars, and the vaults with patens; the arch ribs are white with flowers in colours, and round the arches is a gold vine on a blue ground. But the blue background is more particularly that of the painter, and from Cimabue in 1240 until about the time of Benozzo Gozzoli in 1400, a blue ground was the prevailing one for all sorts of wall decoration. I have taken S. Francesco at Assisi, and the Arena Chapel at Padua, for specimens, as later work is, as a rule, very inferior in point of effect.

In the upper Chapel of S. Francesco at Assisi, the dado is painted in imitation of diapered hangings of a dull red, green, or yellow colour, with geometrical ornaments of a lighter tone; these painted hangings have a border and hang in loops, over which is a painted string, and above is a line of pictures, separated by twisted columns, supporting an entablature, painted stone colour; the upper pictures are divided by bands of ornament; the vaulting shafts are painted in imitation of porphyry or serpentine, or covered with zigzags or chevrons; the caps had gold foliage on a red ground; the ribs of the vaulting are half octagon, covered with panels in mosaic; the side perpendicular to the vault is ornamented with scrolls or interlacing foliage; on the vault, between the ground and the ribs, is a wide band of the same sort: the ornament is almost always green on a red and blue ground; the vault is blue with gold stars and circular panels containing heads, and here and there a subject on a yellow or gold ground instead of the blue and stars; the wall and arch ribs are generally panelled, with heads and foliage alternating; the drapery of the figures is almost always lighter in tone than the back-ground, and the effect of the whole is that of a warm glow.

In the Arena Chapel the dado is in imitation of marble, with light styles and rails, and the panels in imitation of porphyry or serpentine, with figures of the seven Cardinal Virtues and the seven

Deadly Sins interspersed, painted in *chiaro-oscuro*; the pictures are divided horizontally by narrow panelling, filled in with mosaic, and vertically by wide bands, containing heads and foliage in panels; the barrel vault is divided into two by a cross band; the vault is blue, powdered with stars, and each half contains five circles with heads. The only difference in the colours and disposition from those at Assisi is, that orange is sometimes used to divide blue and red, and in the band that divides the vault, we have pink next black, and green on black. At the Campo Santo at Pisa, at the Bargello, and at Sta. Croce at Florence, the disposition is nearly similar to those already mentioned; at S. Benedetto at Subiaco, and at Sta. Maria in Classe at Ravenna, the dado is a sort of mosaic of yellow and green, divided by white lines, on a red ground; and the columns and circular ribs are ornamented with zigzags, chevrons, or interlacings.

The greatest works on a white ground are the painted temples, &c. of the Egyptians, but of these I can hardly form an opinion. It is difficult to judge of the effect of the colour of any object from a drawing, as the artist always gives some tinge of his own to it, and when he reduces it to a smaller scale, he is always inclined to make the colours brighter; but when we have to judge not from drawings, but from books, the task becomes impossible. The book is to pay, or at least to be published at such a price that some copies of it can be sold; and hence the question is, how can an idea be given by employing children to colour it, or by printing it with the fewest number of stones. I can but quote Champollion's words, and state what opinion I have come to from his plates, and the piece at the Crystal Palace. Champollion says—"I should like to introduce into the great Temple of Ipsambul all those who refuse to believe in the elegant richness that painted sculpture adds to architecture; in less than a quarter of an hour, I engage that they would perspire out all their prejudices, and that their *à priori* opinions would quit them at every pore." The general arrangement of the painting (for when sculpture is painted, we can make no distinction) is very similar to that already described. There is a dado composed of the lotus or chevrons. Two or more lines of subjects, divided horizontally by ornamental bands and hieroglyphics, and vertically by hieroglyphics only; an ornamented architrave; another line of hieroglyphics, and then the large cavetto cornice and head. The columns have their capitals painted green if consisting of foliage, but in other respects they are treated like a wall, with the dado running round them, and ornamental bands and hieroglyphics between the subjects. What the effect may be when the interior of one of these temples is lit up by the golden reflection of a burning sun can only be described by one who has seen it; but judging of it as we can, though there are some harmonies of blue and green, and white, purple and green, yet the ochreous yellow and the prevalence of black lines, give it rather a coarse appearance.

In Italy there are very few instances of the white ground; the sacristy and the crypt of the Arena Chapel at Padua are examples—both are whitewashed. At the springing of the vault there is a broad band of blue and green ornament on a red and black ground; the vault is powdered with large red and green stars alternately; the groin point (it is a Roman groin) is painted with a wide green stripe, then a yellow one on each side, and then a red. I think that painting on a white ground was never used in Italy until about 1400, except from motives of economy.

Sta. Anastasia at Verona is the only perfect specimen I know in Italy of decoration on a white ground; and although from some of its ornaments I should judge it to be German work of the 16th century, some of the ornaments have the character of a much earlier date, much more resembling the Norman ornament of France and England. The effect is very good, and is principally got by red and green. The floor is paved with red, black and white marble, in scales; the columns of the nave and the pilasters of the clerestory are in bands of red and white marble; the arches round the windows and the wall and arch ribs consist of seven courses of red bricks and an equal space of white; above the nave arches are two lines of green scroll ornament, separated by a white space with a green

line on it. The vaulting has a circle in each triangular compartment, containing a head surrounded by green foliage, or a line forming a geometrical pattern, and at the side of the ribs there is a red scroll on a black ground, resembling in character that between the balls in the arch rib at Ernée; the ribs of the transepts are half painted in bars or chevrons. In fact, this, like most of the French churches, is only a system of half painting, but a more perfect and agreeable specimen.

The painting of Norman churches was not confined to half painting or mere ornament, but the walls and vaults were covered with subjects; the most celebrated one in France is St. Savin in Poitou. I have not seen this church, but a Norman chapel at Ernée, between Mayenne and Laval, has the ribs painted with zigzags and pateras; the vaulting is white, with red rustics and red flowers, and the half-dome of the apse is divided into three compartments in width; in the centre is a vesica piscis enclosing the figure of Christ; at the corners, outside the vesica, are angels; the sides are divided into two panels in height; the lower panels contain on one side St. Benedict, on the other side a Bishop, with an angel above each of them; and in the semi-circle left at the top is a Norman tree. It is worthy of remark as to the painting of that date, that the Bayeux tapestry is on a white ground outlined in black.

Benozzo Gozzoli, and the painters about his time, used a white ground for the purpose of getting more relief to their figures. The arrangement is the same as on the blue ground; the ornamental borders generally have angels or cupids supporting a wreath, containing a saint's head, and different coloured foliage on a coloured ground. The general tone of the pictures is a pale greenish grey.

In general painted sculpture only differs from painting by its having greater durability; but the sculpture of the Alhambra would have been an expensive folly without its painting, and its painting would lose more than half its value were it not applied to delicately-subordinated surfaces. All the leading patterns are traced out on one surface in gold; the minor patterns are on a second or third surface, and are either in gold or white. The background (if background we can call it) is red and blue. The grey effect is got, in the same way that a miniature painter gets it, by stippling; all the colours are minutely divided; the red or deep blue only tells in little spots, the rest being shaded off by the projections. The patterns are most wonderfully managed; the main gold lines are not an inch broad; the subordinate ones are cut into hollows with ball flowers in them, all the cut parts being red, so as really not to present more than from one-eighth to one-sixteenth of an inch of gold, and the white lines which form patterns rarely exceed one quarter of an inch, the rest being covered with fine blue ornament; in the subordinate ones the blue leaves only one-eighth to one-sixteenth of an inch of white. When looked at close the ornament presents an intricate appearance, with gold, blue and white running one into the other; but every different point of view brings out a fresh pattern, and in so extraordinary a manner that when looking from one side to another, we cannot believe that the ornament we are looking at close can have the effect it has at a distance; so that we are almost inclined to agree with the Moorish poet, who says—"Look attentively at my elegance, thou wilt reap the benefit of a commentary on decoration." I cannot refrain from expressing my gratitude to Mr. Owen Jones for having given us so lovely an example of colour. The lower chapel at Assisi, the Alhambra Court, and the stained glass of the Duomo of Florence and of Chartres Cathedral, are things which, once seen, can never be forgotten.

Pompeii also furnishes us with a commentary on decoration, but of the opposite kind to that of the Alhambra. It contains specimens of almost everything that is to be avoided in decoration; bad drawing, bad perspective, bad ornament, and bad colour. The general disposition is like an ordinary room in the present day, with frieze, cornice, and dado, and the walls in panels; in these panels we find single figures or groups, subjects, arabesques, and a fantastic kind of architecture; there are hundreds of columns, but hardly one that suggests anything elegant; all sorts of scrolls and

patterns, but most of them thin and meagre in form and badly filling the spaces. Every kind of colouring has been adopted; light dados and dark friezes, dark dados and light friezes, dark and light panelling, and every sort of colour, but yet there is hardly a good bit in the place; age and the gradual operation of decay have rendered the effect more harmonious, but there is nothing which we should wish to have copied about us irrespective of the association.

Perugino must have seen some of the Pompeian work or some ancient arabesques, and must have taken from them his style of decoration. He was the last of the decorators or architectural painters, and most of his work is bad in colour; his backgrounds consist of large masses of black and red, which will not compose but resolutely stand out in their own individuality. The Sala del Cambio, at Perugia, is painted with a peculiarly unpleasant hot red on a black ground, and with colored arabesques on a gold one alternately, while the ceiling of the chapel has large patches of red; the one is too dull, and the other too glaring. Raphael, Michael Angelo, and Giulio Romano came next, and then decoration was at an end. Raphael was no doubt misled by the taste shewn for the Roman arabesques just found, and though his school of Athens shews that he could paint pictures that are agreeable as decoration, yet he was generally careless of what became of the room, so that he succeeded with his pictures: he was no doubt much influenced by Michael Angelo, whose pictures are never decoration at all. The specimens of Giulio Romano, at Rome, shew a taste for a sort of hot red that would render any room positively unpleasant to live in; of his decorations at Mantua I cannot speak as I have never seen them. Raphael and Michael Angelo painted pictures that are worth the spoiling of any room to receive such gems of art, but to them we must chiefly ascribe the separation of architecture and painting; they might, had they liked to sacrifice a little of their force and projection, have made their pictures both inseparable from the rooms and charming as compositions of colour.

I suppose in the present day we can hardly expect artists to paint on a blue or gold ground (of course I am speaking now of wall painting), as they would lose too much of that roundness and depth which they so much aim at; but until they will take a Chinese plate with a pale green or white ground as a pattern, and propose to themselves telling their story, and trusting only to beauty of form and lovely tender colours, wall painting will never be popular in England; for very few rooms can afford to have three-fourths of the light absorbed by black backgrounds and dark broken tones of blue and red.

I originally proposed to consider the way in which colour has been applied to exteriors and statues, to stained glass, enamels, and stuffs, but fear I have already almost exhausted your patience, and my task would be very imperfectly done if I were not to endeavour to draw some deductions from the different specimens of decoration which we have been considering. The colourist like the poet is born and not made; yet as so many more persons are concerned in applying colour as an art than in writing poetry, it is of more consequence that we should up to a certain point have the power of making colourists than poets. Art I imagine to be a science of which the laws are not known, and consequently the colourist is one who works intuitively; but as science is only to be discovered by observing a large number of facts, I have endeavoured to make what observations I could upon the beautiful in colour; others have done and will do the same, and when sufficient examples have been collected, some philosopher will deduce the laws.

I shall spare you a recital of the technical terms of colour, of Field's chromatic equivalents,* and

* It appears to me to be extraordinary that this question of the chromatic equivalents has never really been set at rest, as it would be easy to ascertain the relative areas that the red and green, blue and orange, and yellow and violet rays occupy, which when combined reproduce white light; and although, optically speaking, the green, orange, and violet rays are not secondary colours (that is, they cannot be formed by the mixture of the blue and yellow, &c.) yet for the purposes of art, the experiment must be much more conclusive than the rough experiments of Field, which even he did not consider absolutely conclusive.

Chevreul's laws of contrast, and enter at once upon the subject of the harmonies. In nature every colour may be found in juxtaposition with every other, and with an harmonious result, but when we come to analyse the means by which it is produced, the subtleties of the method baffle our investigation; the sculptured surface with its light and shade, the texture, the infinity of tints and colours, all making up one, render all our attempts at perfect imitation or comprehension impossible; still as we get our impressions of what is beautiful from nature, it is to her we must go when we want to find out the reason of the harmony. The most usual harmonies in nature are those of gradation or succession. The harmony of gradation is where one colour gradually rises or falls, either from white through any colour into black (as from white through blue into black in the jay's wing), or from a pale tint of a colour to its darkest shade, yet never going out of the normal scale; the harmony of succession is where green passes into yellow or blue, yellow into orange or green, violet into red or blue, red into orange or violet; or where the whole prismatic scale is used up, and we begin at one colour, and gradually pass through the whole seven. Next in frequency to these come the harmonies of contrast, that is, the harmonies of the complimentary colours; and lastly, the alternate harmonies in which red with blue is the worst, and red with yellow not much better; the agreeable ones are orange and green, yellow and blue, green and violet,—we have in addition to these the harmonies of colours with white and black: with white, yellow, green and blue are the most common; with black, the best are crimson, scarlet, orange, and bright emerald green, not the green of the paint but the green of the jewel. There are many brilliant and delightful harmonies with the secondaries and the tertiaries and black; thus we have citron, olive, and russet in metallic colours, with black, in the Honduras turkey, and russet, violet, green citron, green and black, green, violet, green russet, green and black, in the peacock. Of the harmonies of tone, those to my eye are most agreeable that are not contrasting; black and white, and the tender pale colours and black, do not appear to me to be agreeable when in large masses. One of the laws laid down by the Educational Committee is, that when a primary and secondary are in harmony, if we give any hue to the primary, the secondary must be tinged with the remaining primary. Thus if red and green are in harmony, as we make the red more violet we must make the green more yellow; as a rule the very reverse takes place in flowers, for as the flower gets more violet the leaves get more olive; thus the scarlet geranium has leaves of a bright yellow green, slightly broken with red or brown, while such flowers as the purple dragon's tongue have dark olive green leaves; this may possibly be to ensure the contrast of tone which almost always takes place in flowers. When colour is applied to sculptured forms, it should as a rule always contrast with the form, and not follow it, as we see in the legs and tails of animals, where the pattern generally takes the form of rings or chevrons, and not of longitudinal stripes. We see then that in any system of colouring we want to associate as a whole such masses of complementary colours as nearly combine to form white light, and leave only that pale red, yellow, green, or grey residuary tinge we may require, and to choose such of the harmonies as we prefer; but we must in our present state of science trust entirely to the correctness of the eye for making the two colours that are to be together really harmonious.

In conclusion I will submit a few deductions derived from the colouring of the works we have reviewed. On a *gold ground*, black and white should be used like jewels in very small pieces, or as lines of separation, otherwise they will destroy the harmony of the composition. The predominant coloured surfaces should not be deeper in tone than the gold ground, and those that are of a very pale tint, nearly approaching to white, appear the most beautiful. The harmonies at St. Mark's appear to be green and red, green and blue, green and violet; but there are other peculiarities to be noticed, as the lovely bead ornament in

the Atrium consisting of eight-leaved flowers on a gold ground, each flower having four blue and four red leaves, and four green and four red alternately, the colours separated from the gold and each other by white; and the beautiful zig-zag border to a portrait on one of the pendentives of the Atrium, in which pale green, gold, pale blue, white, grouped on one side of the indent, and green, red, blue, white, on the other, are found on a black ground. On the *blue ground* the divisions are almost always effected by white lines, but the prevalence of masses of white or black destroys the effect. The harmonies here include nearly every one, but the commonest and best are those in which the green foliage makes a harmony of contrast on one side with the red, and an analogous harmony on the other with the blue. We have orange between blue and red, orange and green, orange and pink, black and green, orange and black, blue and violet. On a *white ground* any colour that is much darker in tone will make a division, and the only thing to be considered is the application of the colours themselves. These must be of sufficiently pale tint not to form violent contrasts of tone. The only exception to this rule is when colours are employed in minute portions; in which case the surrounding white will sufficiently lower them in tone to make them agreeable. But my advice to any one about to paint on a white ground, is to possess himself of one of the best kind of china plates. For the system of stippling the work of India is the one to be studied; in fact, for every thing connected with ornament or colour, it cannot be studied too much. A few square inches of an Indian shawl form the most perfect master we can procure; and were I to describe the piece I have copied, which is hanging on the wall, I might have given a commentary on decoration in a small space. I must now conclude. Though no one can be so fully aware of this imperfect accomplishment of a very difficult task as myself, yet the short time I have had to devote to it must be my excuse for its length and its shortcomings. But as it is the subject of all others that I most delight in, it is from no want of will that it is not perfect. I only trust that some one more able than myself will take the subject in hand, and elucidate those laws which are at present but matters of feeling or taste.

Mr. BRUGES, Visitor, said he could add very little information to that given in Mr. Aitchison's excellent paper. His own studies had been mainly confined to Mediæval and Pompeian buildings. He thought the Pompeian colouring very agreeable, though rather forcible; but the natives of hot climates required strong colours, because their buildings could only have small windows for the admission of light. With regard to Mediæval colouring, Mr. Aitchison had referred to it in connection with the blue, the gold, and the white ground respectively, but he (Mr. BRUGES) thought that an architect would rather divide it into two classes, the finished and the unfinished. When a cathedral was built they put stained glass in the windows, and obtained colour by that means. There was so little wall space that there was no room for pictures. The consequence of this was, they left it white, each of the piers being exceedingly small, and then they continued the colours of the windows by picking out the hollows of the principal mouldings with red, the only parts strongly decorated being the bosses and the mouldings of the ribs, for about one foot from them. This system was found at Chartres, Beauvais and Ely. Occasionally, but not very often, the capitals were coloured and gilt, as at Cologne; where, however, they adopted strong colouring, as at the Ste. Chapelle, and coloured the space between the windows, the effect was exceedingly bad. As regarded coloured decorations, he thought the Ste. Chapelle was exceedingly bad, and that it would not bear comparison with the Lower Chapel at Assisi. The western and southern systems could not go together. If we wanted colouring in a building, we must give up the mouldings, or *vice versa*: for his own part, he would always give up the mouldings. In the case of the chapter-houses at Salisbury and Ely, they

went further than in the cathedrals. At Salisbury they gave very little colour to the glass. It was nearly all grisaille. They then coloured the hollows of the mouldings, and richly decorated the bosses and the space immediately surrounding them on the vaulting; the rest of the vaulting being covered with red lines in imitation of stone joints, a very common system of decoration in the lower coloured buildings of the Middle Ages. On one occasion he was in the little church of Mollinet, near Rouen, and found that it was almost in the same state it was in during the Middle Ages, and that nearly every square inch of it was covered with some decorative pattern. In the case of Salisbury Chapter-House, the colour was gradually brought down from the bosses by means of a little white, red, or yellow on the ribs, until it reached the windows. These had the circles in the tracery, and a band of shields running along horizontally through all the lights, in full lined rich-coloured glass. The borders continued this colour to the bottom of the windows, where the arcade round the whole of the building was most richly and fully decorated. It was the same in the Lady Chapel at Ely. They brought the colour carefully down; the windows were all of stained glass, with a far greater proportion of white and yellow in them than at the Sainte Chapelle; the effect of which latter he could not help thinking decidedly bad. In Italy, if they wanted colour in a church, they used Mr. Aitchison's blue ground, and separated the pictures by borders with a thin white line on either side; for it was these white lines, and not the borders, that made the real line of separation. On the other hand, they took care not to lessen the effect by mixing white with it. It was pure good blue, and upon it they painted in tender colours, such as light pink and light red, and white, shaded with different tones of blue and red; and sometimes they even used a scarlet figure to vary the effect. At other times they used a beautiful light purple, which was a great favourite with the artists of the Middle Ages: all these colours were to be seen in perfection in Van Eyck's picture of the Adoration of the Lamb. When they used gold grounds, as at Palermo, they still used light colours, but separated by means of darker ones, only in much smaller proportions. After all, the effect of a building would depend a great deal upon the light. The Upper Chapel at Assisi looked nearly as bad as the Ste. Chapelle, because there was too much light in it; on the contrary, one of the reasons for the Lower Chapel looking so beautiful was, that the light only penetrated into it through the windows of the side chapels. It was not for him to attack M. Chevreul, or to say he did not think he had an eye for colour; but, in his own opinion, all that was known of colour was derived from nature. He had himself taken all the pains he could to study the colours of flowers, birds and butterflies, and he had endeavoured to make out a law on the subject; and if he had discovered any law of harmony in colouring, he should only be too happy to state it; but this was not the case. As to the future of architecture, in regard to the decoration of buildings, we must have figures and employ the painter, for all decorations without figures always appeared to him to be exceedingly tame. We must get the painter to treat the building as an architect would, and put an architect over him to look after him; but it would be better still, although we might have to wait for two or three generations, if architects turned painters themselves. Let them erect the building, and then decorate and paint it, and so leave a thoroughly perfect good work behind them.

Mr. PENROSE, Fellow, observed that in the present state of polychromatic knowledge it would be wrong to lay down too many dogmatic laws. A few, it was true, might be laid down; such as the advantage in most cases of separating strong colours by delicate white or other lines, and that the combination of certain colours will produce discord; but it would be dangerous to assert many points very positively; and more research and more experiments were necessary before rules could be laid down to any great extent. At present many persons were deterred from the subject by an apprehension of its great difficulty, whereas he thought that the study of colour in land-

scapes, flowers, birds, butterflies, &c. would do more than a great deal of scientific inquiry. The great success of the untutored races in the application of colour must point out the study of nature as the best guide in the first instance; but as commentaries on the book of nature the great works of art of antiquity were of great importance. The key in which a building should be coloured depended very much upon its purpose. In some cases a white ground, or one so nearly white as not to be crude, was the best; in other cases, where only a moderate light was admitted, deep blues and reds were best. He had been led to think that in all cases where deep colours were employed, the more they were in the shade the better—always however excepting mosaic, which, from the transparency of its coloured ground, and the reflections, enabled it to bear more light than any other kind of coloured decoration; but the effect even of this was impaired by a very strong light, as was shown in a tribune exposed to the south near the Lateran at Rome, where the effect was glaring and inharmonious.

Mr. LOCKYER, Associate, said that the mosaic referred to was a modern specimen; but in the façade of Orvieto Cathedral the effect was very different, the figures having the appearance of floating in a sea of gold. The mosaics at Sienna were modern.

Mr. PENROSE repeated that he had made an exception as to mosaic, which was indeed the only form in which brilliant colouring would bear a strong light. While he agreed with much that Mr. Aitchison had said, he differed in that he considered the later mosaics in the apse of St Mark's, Venice, in all respects equal to, and in some points more beautiful, than those of the earlier period.

Mr. A. J. BAKER, Associate, said that one of the most important laws of the arrangement of coloured decorations received much less attention than it deserved—he alluded to the juxtaposition of light and dark colours, "the chiaro-oscuro," as it was called by painters. If the most harmonious series of colours were arranged together without a variety of depth the effect was tame, and the outlines viewed at a distance became blended into a confused mass; but if due attention were paid to strength as well as to harmony of colours the composition became most satisfactory. Examination of the best examples would at once prove the importance of this law. In some of the finest of the Italian designs the strongest colours were the blue and maroon, at a distance they caught the eye as dark masses; red was the intermediate tone with pale green and yellow, the lightest forming the bright part of the pattern.* Other beautiful examples might be investigated with a similar result, but it was unnecessary to bring further evidence.

Mr. FOWLER, Fellow, referred to the discovery, some fifty years ago, of some paintings on the walls of the church of the parish in which he then lived, which shewed that the entire building, mouldings and all, had been coloured, and that it was originally a specimen of the richest kind of polychromatic decoration, of the time of Henry VII. From some feeling, however, that these works were connected with Popish superstition, the vicar of the parish had them all covered up again. The paintings had excited much astonishment and admiration at the time, but he only referred to them now as a matter of history, and to contrast the feeling of architects and antiquaries at present in reference to such subjects with the state of feeling which then prevailed. He had himself always felt that this was a branch of their art which demanded much more study than it had received; and he was

* The elegant coloured patterns on Indian shawls depend in a great measure for their beauty on the brilliancy and harmony of the colours, but these are so divided by white or yellow lines as to produce a slight effect of light and shade. But so slightly is this effect produced that at some distance the colours fuse into a pale brown tint, and the pattern is but feebly marked by the white lines. For this reason, beautiful as these patterns are, they should be employed only on small surfaces, where the eye can take them in at a glance; in the shawls they appear to most advantage when contrasted with masses of simple red or green.—A. J. B.

very glad to see it taken up as it had lately been. With regard to the *Sainte Chapelle* the architect deserved great credit for working out a great and striking experiment in a most elaborate manner; and its existence, as a matter for speculation and criticism, was at all events a gratifying circumstance. He himself agreed with those who considered that it was overdone. The great requisite in coloured decoration was to mark and bring out in their integrity the columns and other structural parts. The illustrations of the Cathedral of Monreale, at Palermo, by the late M. Zanth, appeared to shew that building was one of the most successful instances of polychromatic decoration, and it was peculiarly interesting as having been executed at a time when the art was better understood than at present.

MR. LOCKYER said that he had no doubt the subject had been a matter of deep study to Mr. Aitchison, and it was one which should not be too lightly discussed; but he could not help dissenting from that gentleman's views with regard to the Pompeian decorations, and the works of Giulio Romano. Any one who had seen the works of the last-named artist at Mantua, at the Villa Madama, and at the Villa di Papa Giulio, must have felt that he was a thorough master of his art; and, although his own taste might be questioned, he must confess that he had been more struck by the works of Giulio Romano than by those of any other Italian artist of that period. Mr. Aitchison objected to his masses of deep red, but in the Italian climate such colouring was required more than in England. Mr. Aitchison had also mentioned that gold had a better effect on a green ground. In Italy the gold which coated the mosaics was chiefly used on glass of a red colour.

MR. M. D. WATT. The glass, of which the gilded mosaic of *Sta. Sophia* was made, was white and clear, at a later period it became green and partially opaque as at *St. Mark's*, and ultimately and up to the present time it has been made of a deep red and opaque tint.

MR. LOCKYER assented. There were indeed very few examples on green, and the effect in one case (at *San Lorenzo*) was very poor. The mosaics at *St. Mark's*, Venice, were relieved, as Mr. Aitchison observed, with black lines; but this was not always the case, as there was very little black in the beautiful room in the Palace at Palermo, where the decoration consisted of delicate tints on a rich gold ground. The mosaics at Monreale were being modernised and repaired by a school of mosaicists which the King of Naples had established there.

MR. KERR, Fellow, understood Mr. Aitchison to say, that the art of colour was a matter of instinct and not of rule; that it was not a matter of science but of intuitive and instinctive knowledge, under the correction of an experienced eye. Now, nothing, in his opinion, could be a greater mistake in the abstract. If he were called upon to define colour in relation to architecture, he should say it was the music of their art. Nothing could be more correctly weighed, estimated, or definitively reduced into system. Not that he would say that it had been so weighed and estimated, and its elements accurately reduced into system; but the work of Chevreul on the subject was exceedingly mathematical in all its processes for the determination of principles on which every one might very safely rely. The interior decoration of a building in modern times with colour must be a peculiarly interesting subject of inquiry to the architect. When he spoke of colour as being the music of their art, he was not speaking altogether figuratively, for he fancied that the interior of a building might be decorated in any one of many ways, just in the same manner as a piece of music might be set to any one or many expressions or sentiments. When we wished to decorate the interior of a structure in a bold and striking manner, or on the other hand, to carry out the work in a smooth and graceful one, we adopted the desired material and design in order to produce the wished-for effect. In the classical times of antiquity, he was inclined to think—notwithstanding all that had been said, and perhaps proved, with regard to chromatic decorative building—that it was not carried on to a very great

extent. Ho, for one, as an admirer of Greek architecture, should be sorry to admit that they did colour the exterior of their buildings. The operation of the mind at that time and in that age was more stern and severe; but when we came to the Middle Ages, we found the mind losing its severity—losing that sternness, and more involved in complication of lighter details; and then in aftertimes, and by gradual progression, the use of colour became more applicable to the purposes of art, and in the Medieval and Renaissance works (which were governed in principle almost entirely by Medieval examples), we found that colour began to be adopted and used, not only with profusion, but with something more than gusto—with intuitive success. Now, the colouring that was to be found in Medieval buildings, successful as it was, was not successful by accident, or by the application of rules, but the existence of rules might be easily discovered. Chereul discovered a great many, and laid down remarks on position. If Mr. Aitchison would only collect the specimens that were hanging on the walls, and assort them in various classes, he would find that certain principles governed one class and certain principles another; which must inevitably be, and without which colour decoration could not be successfully employed. It was different with form, the other great principle and department of their art. They could not weigh form, but they could, as it were, weigh the music and poetry of colour, and so lay down fixed principles of action. Indeed, there was no subject in the present day more deserving the attention of scientific men in relation to architecture than colour.

Mr. DONALDSON, H. S. F. C., said that the one great principle, which should guide an architect with regard to decoration, should be to express a defined purpose; but it was often difficult to ascertain the intention of the kind of decoration which was adopted. The architect should always take the leading position in a building, and all decoration should be subservient to the architecture, and calculated to give effect, by contrast, to the various constructive features. Mr. Burges had well observed that in Medieval edifices the colour was applied in the hollows, so as to throw out with more effect the smaller mouldings and columns. Where, however, colour was made to usurp the place of architecture, and so applied as to make one building material represent another, architecture held only a secondary and degrading position. Architecture might be appropriately decorated by the use of differently-coloured marbles, of which the friezes and other parts might be constructed; but there should be no artificial or imitative decoration. Colour should not represent architecture, but architectural decoration. He could not conceive the object of covering the beautiful architecture of the Sainte Chapelle at Paris with an artificial coat of colouring, and the same objection applied to St. Stephen's Chapel, Westminster, the walls of which (as shewn by a drawing which he had seen some forty years ago) were covered with colour and gilding, most harmoniously blended, but resembling tapestry hangings, and destroying the effect of the architecture. He differed from Mr. Aitchison with regard to the paintings at Pompeii, which, as they were in shade rather than exposed to the sun, were exceedingly harmonious; and the forms of which, presenting as they did small columns, diminutive entablatures, fantastic doors, and other capricious decorations, represented a class of domestic architecture then existing, but of which there were now no remains. Similar forms might easily be reproduced in iron; and executed in bronze, as they doubtless were by the ancients, they would be very appropriate. He could not approve of the decoration of the Baths of Titus at Rome, but had been much pleased with the villas near Rome, represented in the work of Mr. Gruner, particularly with some paintings on a white ground, the colouring being in fact more brilliant than the peacock's tail referred to by Mr. Aitchison. The remains in the British Museum shewed that the Egyptians knew the value of the white line. With regard to Giulio Romano, he thought his works at the Palazzo del T generally puerile, and a caprice or exaggeration rather than an effort of genius. At the Villa Giulia there were many works of Vignola as well as of Giulio

Romano, and it was necessary that the works of these masters should not be confounded. Mr. Donaldson concluded by moving a vote of thanks to Mr. Aitchison.

Mr. AITCHISON said that he had wished to avoid expressing any prejudice against or partiality for particular styles. He had been guided by his own eye in studying coloured decoration, and had endeavoured not to be led by the opinions of others. He now found two objections made to his remarks:—one, that he had not studied nature,—the other, that he had not studied art—but he had read nearly every book on the subject from Hayter's ultimatum down to Chevreul. With regard to Monsieur Chevreul's book, he had studied it with care, but thought there was nothing like mathematical demonstration in it. All indeed that had been shown by that author was, that when two tones of the same colour were put together, the light appeared lighter, and the dark darker, and that when *two colours* were put together, each was tinged with the complimentary of the other; but as to harmony M. Chevreul had, in fact, taken certain colours, and those which he found agreeable to his own eye he called harmonious. With regard to nature, he (Mr. Aitchison) had studied the common flowers which had fallen in his way, and such birds and butterflies as were to be seen at the British Museum and the Zoological Gardens; and the harmonies of the mosaics of St. Mark's were exactly those which were continually found in nature. It was somewhat difficult to judge of the paintings of Pompeii, and it was some time since he had been there; but in almost every case he remembered the effect was spoiled by large masses of white or black being used with colours in their full intensity, and as to harmony, although there were some good ones of violet grey and yellow, and green and black, yet there was a great preponderance of yellow and red, and of red and blue in the panels. With regard to Giulio Romano, he was said to have painted the "History of Psyche," in the Farnesina at Rome, the colour of which he (Mr. Aitchison) thought horrible; and many of his friends agreed with him. The works of this artist were fanciful pieces of ornament, some of them in beautiful harmony, but bad in point of composition, and (as was the case with Perugino and others) while they might be beautiful in small pictures, they were not successful as decorations for an entire building. In the sacristy of St. Mark's gold and white were employed almost exclusively, it was therefore hardly an example of colouring. He had alluded to the old figure subjects over one of the doors, which, when seen from the other side of the Piazza, were of a pale beautiful green tinge; the other he referred to was a sixteenth century one with a great mass of blue drapery, which some admired, but which he did not. Mr. Baker had remarked that colours could not be agreeable unless they were contrasted in tone, but the Hindoos and Chinese generally used the colours in their normal purity. The Indian shawl pattern which he produced was only one of £600,000. worth imported every half year. The red, blue and green in this example were almost exactly of the same tone, but most carefully massed and shaded off. The inability to distinguish colours was one of the commonest forms of colour blindness; for many people could tell the difference of tone but not of colour. Upon the general question whether painting should be applied to architecture, he had to contend with the prejudices which had grown up with people from their youth; but in taking nature as their guide, it was found that all kinds of animals and birds were coloured and covered with most beautiful patterns. In shells, too, colour was applied not so as to bring out the form, but to contrast with it often in lines passing at right angles with those of the shell itself; and the same remark applied to birds and fishes. Even the legs and tails of animals were covered with rings, or chevrons, and not striped in the direction of the limb.

The vote of thanks was carried unanimously, and the meeting adjourned.

A FEW OBSERVATIONS ON THE EARLY HABITATIONS OF THE IRISH, AND ESPECIALLY THE CRANNOGES OR LAKE CASTLES.

By M. DIGBY WYATT, Hon. Sec.

Read at the Ordinary General Meeting of the Royal Institute of British Architects,
January 11th, 1858.

WITH the prospect before the meeting of the interesting paper on the round towers of Ireland, promised us by Mr. Hills, I feel that some apology is due for the few remarks I purpose bringing under your attention. I find the materials for that apology ready to my hand in three facts,—firstly, that this evening we receive as a present from its author, Mr. W. R. Wilde, Hon. Sec. for Foreign Correspondence to the Royal Irish Academy, one of the most important contributions which has yet been made to the complete illustration of the early art and ethnography of the sister island,—secondly, that we have been favoured by the Royal Irish Academy with the loan of some very careful drawings of the most interesting class of Celtic monuments, which have been recently brought to light,—and thirdly, that you may be better enabled to judge of the probability of the theories originated by Ledwich, O'Brien, Vallancey, Petrie and others, which will no doubt be brought under your notice by Mr. Hills, if you are at no great sacrifice of time, made acquainted with some of the most curious vestiges which remain of the domestic monuments erected by the primeval race, to whom, or to whose descendants, we are no doubt indebted for the round towers themselves, and the curious remains generally found in their immediate vicinity.

It may possibly be objected that the interest associated with the Celtic monuments of the early occupation and Christianity of Ireland is of an Archaeological nature alone,—a very little examination will remove this prejudice.

One who has paid profound attention to the peculiar types of Celtic design, Mr. J. O. Westwood, thus expresses himself on the subject in Mr. Owen Jones' Grammar of Ornament:—"Even supposing the early artists of these Islands might have obtained the germs of their peculiar styles of ornament from some other source than their own natural genius, they had between the period of the introduction of Christianity (possibly in the fourth and certainly in the fifth centuries), and the beginning of the eighth century, formed several very distinct systems of ornamentation, perfectly unlike in their developed state, those of any other country; and this too, at a period when nearly the whole of Europe, owing to the breaking up of the great Roman Empire, was involved in almost complete darkness as regards artistic productions."

Surely it can be no unprofitable or uninteresting task for us as architects, to examine into the domestic as well as the ecclesiastical structures, which were reared by these singularly original artists. It is no exaggeration to state that the soil of Ireland still teems with historical relics of a monumental character, to record the precise positions of which, it is a great gratification to find, has been made a labour of love in the preparation of the excellent Irish Ordnance Survey. The Museum of the Royal Irish Academy vies in its illustration of ancient Celtic life and art, with the position occupied by that of Copenhagen, in reference to all that is most interesting and instructive in Scandinavian; while Mr. Wilde as a learned and popular teacher rivals in his catalogue the ability and enthusiasm of the well-known Worsaae, whose essays on northern Archaeology are full of interesting information.

Some of the rude structures to which I purpose very briefly drawing your attention, were no

doubt inhabited by those noble youths whose mission it was to evangelise, first, those portions of their own Island which still adhered to Paganism, and subsequently many other countries of Europe. Among the earliest of such "societies for the propagation of the gospel in foreign parts," were the bands who carried the cross to the regions of the North, and with it took those singular types of ornament which were slowly adopted by the Scandinavian artists during the tenth and eleventh centuries. The monks of Iona, under the great Irish Saint and Scribe, Columba or Columbkil, and their Anglo-Saxon disciples at Lindisfarne, under his friend St. Aidan, together with the Irish monks at Glastonbury, spread Celtic ornament in England, from which it had to a great extent retired with the expulsion of the Ancient British. St. Boniface, the principal awakener of Germany to Christianity, carried with him his singularly ornamented book of Gospels, which is still preserved as a relic at Fulda. Similar evidence of the transmission of the art prevalent during the early centuries of the Church in Ireland, to other lands by means of the Missionaries who left her shores, is to be found in the books of St. Kilian, the apostle of Franconia, still preserved at Wurtzburg, in those of St. Gall, now in the public library of St. Gall, in the Canton of Switzerland, which still bears his name, and in the very important series connected with the Monastic Institution founded by St. Columbanus, at Bobbio, in Italy; of which last, Muratori has given an interesting catalogue. Many of these saints were themselves scribes, and their autograph copies of the Holy Gospels are still in existence, with the name of the writers in some cases, identifying the volumes and absolutely fixing their date. Thus we have the Gospels of St. Columba, the *Leabhar Dhimma*, or Gospels of St. Dhimma Mac Nathi, and the *Mac Regul* Gospels in the Bodleian Library. All of these are anterior to the ninth century, and are distinguished by an elaborate style of ornament, unlike any other European type. In delicacy of handling, and minuteness of faultless execution, the whole range of paleography offers nothing comparable to the early Irish and British manuscripts. When in Dublin, some years ago, I had the opportunity of studying very carefully the most marvellous of all, "The Book of Kells," some of the ornaments of which I attempted to copy, but broke down in despair. Of this very book Mr. Westwood examined the pages, as I did, for hours together without ever detecting a false line, or an irregular interlacement. In one space of about a quarter of an inch superficial he counted, with a magnifying glass, no less than one hundred and fifty-eight interlacements of a slender ribbon pattern, formed of white lines, edged by black ones, upon a black ground. No wonder that tradition should allege that these unerring lines should have been traced by angels. The careful student of Carolingian design, cannot fail to trace in much that was done by the great Emperor of the Franks, the influence of the Celtic sages who were nearest to his person.

Despite the dignity of these Hibernian heroes from the days of Pelagius and St. Patrick in the 5th century, and the respect their Schools and Colleges acquired abroad, their habitations and those of their countrymen and contemporaries, appear to have been of the very simplest.

Detached houses of stone were erected only at somewhat late dates—that material in early days having been reserved almost exclusively for the round towers and crosses, the small churches, and the military defences with the rude huts enclosed within them. The dwellings themselves appear to have been constructed for the most part of wood, or of wattles, with clay filling in the interstices. Remains of ancient stone and earthen forts, in which numerous habitations were included, are still frequently met with throughout Ireland; though vast numbers have no doubt been destroyed by time, and from the land having been brought more generally into cultivation. The fortresses known as *Cahirs* (Carr. Welch?) or *Cashils* (Castles?) amongst which are Taltin, Tlachtgha, Tara, Croghan, the *Grianau* of Ailceach, in the county of Donegal, &c. are built invariably of stone, and appear to have been the strongholds of the then numerous princes and chiefs,

together with their followers:—The Hill Forts, called "Duns" or "Lisses," though occasionally formed of earth when stone was difficult to be procured, are chiefly built of the latter material, and entirely without cement; the walls often being many feet in thickness. They are generally circular, and all contain small chambers, consisting only of flat stones laid across large upright ones, and from the quantities of bones found in some of them, they appear to have been used as well to contain stores of provision as for the protection of the women and children. A few Duns have staircases formed in the inner side of the wall and leading to platforms near the top, from whence the defenders of the fort could observe, and possibly attack their assailants. "They are found commonly, observes Mr. Wakeman, in his excellent hand book of Irish Archaeology, along the western and south-western coasts of Ireland, and upon the adjoining islands. They probably owe their preservation to the abundance of stone in the districts where they are generally found, the neighbouring inhabitants thus having no inducement to destroy them for the sake of their materials. A model of one may be seen in the Museum of the Royal Dublin Society House, of the Catbair at Staigue, in the County of Kerry, probably the most perfect example of its class to be met with in any part of the south of Ireland. It consists of a circular wall of uncemented stones, about 18 ft. in height, and 12 ft. in thickness, enclosing an area of 88 yards in diameter. Upon the internal face of the wall are regular flights of steps, leading to the highest part of the building. The doorway is composed of large unhewn stones, and is covered by a horizontal lintel. A ditch now nearly filled up, anciently defended the wall upon the exterior."

The earthen forts called "Raths" are chiefly, if not exclusively, to be found in the plain. Like the stone forts, their enclosures are generally circular, and in the raths these are always formed of an earthen embankment, from four to eight feet in height, which was probably strengthened by a wooden stockade upon it. In some cases these forts were rendered more difficult of attack by the addition of a ditch, which surrounded them outside the embankment.

Mr. Wakeman, who has carefully studied these singular constructions, states that "of the number of raths which he had examined, he had not in one instance known the mound to contain a chamber; but when the work consists merely of the circular enclosure, of which mention has been already made, excavations of a bee-hive form, lined with uncemented stones, and connected by passages sufficiently large to admit a man, are not unfrequently found. These chambers were probably used as places of temporary retreat, or as storehouses for corn, &c. &c.; the want of any ventilation, save that derived from the narrow external entrance, rendering them unfit for the continued habitation of man. We are not aware that any rath in the neighbourhood of Dublin contains a chamber or chambers of this kind. They are common only in the southern and western parts of Ireland; but subterraneous works, similar to those usually found in the forts of Connaught and Munster, occur in Meath, and perhaps in other Leinster counties."

Within these defences, whether of stone or earth, were usually built the huts of wood or wattle and clay, or the small stone cabins called *Cloghauns* or *Clochauns*, in which the people lived, the enclosures giving protection not only to them, but also to their cattle and stores, which in those days were in constant danger from robbers, beasts of prey, or the attacks of hostile tribes. It was this very sense of insecurity which no doubt led to the creation of the singular places of refuge and occupation, to which I desire to especially draw your attention this evening.

The discoveries connected with *crannoges*, or artificial islands, formed in the lakes, furnish the most interesting illustrations of the ancient Irish social or anti-social system, which have been brought forward since Dr. Petrie's publication of his admirable essay upon the Round Towers. It is to Mr. Wilde that the credit must be given of first bringing before the Royal Irish Academy in 1830,

the particulars of one of these remarkable structures, for despite the fact that the ancient annals of the country abound in references to them from the year A.D. 548 to the commencement of the seventeenth century, it was not until the year 1539 that any one was identified and investigated. It is also singular that the one first discovered is at once the most perfect, the largest, and the one of which the earliest historical account is preserved—mention being made of it in the *Codex Clarendensis*, by which we find that it was inhabited more than 1000 years ago. Loch Gabhair, in which this crannoge, known as that of Lagure, or Dunshauglin, was situated, is in the county of Meath, and is said by tradition to have been one of the nine lakes which suddenly appeared in Ireland about 2000 years ago. The draining of this lake some years since left in its place a marsh or bog, in the midst of the remains of which this ancient fortress may still be seen. Like most of the strongholds of that time, it is of a circular form, and, like the greater number of these wooden islands, could only have been approached by means of a boat, a few only having had a causeway connecting them with the mainland. The Lagure crannoge is about 520 feet in circumference, being the largest which has yet been discovered, and is thus minutely described by Mr. Wilde:—"The circumference of the circle was formed by upright posts of black oak, measuring from 6 to 8 feet in height; these were mortised into beams of a similar material, laid flat upon the sand and marl beneath the bog, and nearly 16 feet below the present surface. The upright posts were held together by connecting cross-beams, and (said to be) fastened by large iron nails, parts of a second upper tier of posts were likewise found resting on the lower ones. The space thus enclosed was divided into separate compartments by septa or divisions that intersected one another in different directions; these were also formed of oaken beams, in a state of great preservation, joined together with greater accuracy than the former, and in some cases having their sides grooved or rabbitted to admit large panels, driven down between them." Some human remains were found within this crannoge, as well as large quantities of the bones of different animals, together with a great variety of weapons, ornaments, tools, querns (stones for grinding corn), &c. Some specimens of the most curious of these relics were brought to London by Lord Talbot de Malahide, and exhibited in 1849. Of one elaborate metal ornament, enriched with minute "opus Hibernicum," or glass mosaic, nearly similar to that which may be found in many Egyptian amulets, I made a careful drawing for his Lordship, from which he subsequently caused an engraving to be executed.*

The Strokestown crannoge, which is situated in Ardskillin Lough, in the county of Roscommon, differs from the fortress just described in its form, which is an irregular oval, as well as in having the addition of a stone wall to the usual fortifications of oaken piling. This wall (referring to diagrams) is in some parts raised upon piles, and was further strengthened, and the island protected from the encroachment of the surrounding water by a circle of sheetpiling: which in its turn was rendered more secure by upright oaken stockades. Upon the stones, marl, and clay of the original island are layers of bones, logs of timber, and ashes, covered to some depth by loose stones brought of course from the mainland. Upon this solid foundation stood the huts of its ancient owners, the hearthstones of which, still bearing the marks of fire, have been discovered in this as well as in nearly every crannoge which has been examined. The lake of Drumaleague, in the county of Leitrim, also contains two very singular specimens of crannoges, revealed by the success of the recent draining operations and illustrated in the drawings upon the walls.

One of the islands is 60 feet in diameter, the outer row of stakes, which in some parts is doubled or trebled, forming a *regular circle*; within which are several groups of stakes which, apparently, have been so placed for the purpose of supporting some superincumbent weight, probably that of the

* Journal of the Archaeological Institute. Vol VI, page 105.

principal huts. On different spots on the surface of the second island were found three hearths formed of heaps of stones, and bearing the marks of fire. Spread all over the top of the island was a stratum of rough logs of alder timber, from 3 to 8 inches in diameter, all lying in the same direction, and all in a state of decay from the long-continued action of water. Under this was a layer of branches and sticks of all descriptions thrown together without regard to arrangement; these too were decayed and rotten. The stratum appeared to be of considerable depth, but the bottom was too soft to admit of its being conveniently excavated to a greater depth than 4 feet. This island is 72 feet in diameter, and is nearly circular; the stockade which forms the circle being only a single row of oaken piles. A canoe was found at what was supposed to have been the old water line; and in one part of the island, at a depth of 4 feet from the surface, a quantity of the bones of pigs, deer, and other animals were discovered. Of similar bones one crannog yielded no less than one hundred and fifty tons.

I should only weary you by dwelling upon other specimens of crannoges differing in no essential particular from those I have just described. Already, since 1830, about forty-six have been discovered in Ireland, and in one county alone (Lestrim) no less than twenty have been found. Aboriginal canoes, formed out of large trees, roughly hewn into shape in some cases by stone celts and hatchets, have been frequently found at the old water line in the immediate vicinity of the crannoges. Several are preserved in the Museum of the Royal Irish Academy. From the frequent accounts in the Irish annals of the burning of crannoges, we may infer that houses, or rather huts, were usually erected of wood upon the artificial foundations of the lake island, and well fortified to resist attack. A singular specimen of a very ancient Irish wooden hut was found in the Drunkelin bog, in the county of Donegal, in 1833. It has been figured and described by Captain W. Mudge, R.N.,* and appears to have been a square hut, 12 feet by 12 feet, on plan, and 9 feet high—divided into two stories in height, each 4 feet high. It was roughly framed in oak, which had been split, and wrought by stone tools, one of which was found lying upon the floor of the house.

An almost identical set of island forts or crannoges with the Irish once have been found in the Swiss lakes, and are minutely described in a work by Professor Ferdinand Keller.*

In conclusion, gentlemen, I would desire to urge upon your attention, in the first place, the admirable work of Mr. Wilde, from which most of the facts I have brought under your notice this evening with respect to the crannoges, have been derived; and, in the second, the real value of Celtic art. Its connection with our country's history, its own individuality, and completeness as a style, illustrated by abundant monuments in stone, wood, metal, vitreous and ceramic materials, leather and vellum, and the fact of its growth and development at a moment when the atmosphere of art was darkened by the dust and confusion of the crash and downfall of Ancient Rome, and its influences, justify me in urging the subject upon your notice. Had these claims been duly entertained in this country as they have been in Ireland, many a monument and object now lost or destroyed might have been preserved for comparison and study, while we might have had in London a collection scarcely less valuable than that of the Royal Irish Academy in Dublin. Too long and too blindly the trustees of our so-called *British* Museum have shut their eyes, their ears, and their intelligences, to the important interests of the material monuments of national art and national antiquities.

* *Archæologia*. Vol. XXVI. page 361.

A REVIEW OF THE ARCHITECTURE AND HISTORY OF THE ROUND TOWERS OF IRELAND.

By GORDON M. HILLS, Esq.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, Jan. 11th, 1858.

At the present day there are very few architectural monuments in any part of the world whose former use and object are not fully understood, and even the long unsolved problem of the Pyramids of Egypt has been unravelled. It is therefore very remarkable that the purpose of the ancient Round Towers existing in our sister island should still be regarded by any one doubtful, although there has perhaps been more writing upon the subject than on any other vexed question of an architectural nature. I now submit illustrations of fifty-seven of these Round Towers, which, with five more, the least perfect remaining, will, I believe, include all that are to be found in various states, from the mere foundation or pile of loose stones to the complete building. In the examination of the towers we must include the buildings in conjunction with which they are invariably found, and to make the survey complete, we must also include those places where round towers are known to have existed. There are one hundred and twenty sites where these round towers either remain, or are reputed to have stood; my own visits have as yet extended to one hundred and four, and the inspection of the sites with reference to the authorities has shown that the number to which they are rightly assigned is somewhat less than one hundred and twenty. I propose then to see whether it is not possible from the architectural features of the buildings to arrange them in a chronological order, and to test and confirm this arrangement by historical authorities; but previously it may not be amiss to mention briefly the various opinions that have been put forth as to the origin and the use of these Irish Pillar Towers.

It was surmised in the seventeenth, and strongly contended at the end of the eighteenth century, that they were built by the Danes; but I believe it is now generally considered that these Scandinavian invaders, who held only posts on the sea side, and who are noticed in the Irish annals almost wholly for their savage and plundering habits from the year 795, their first invasion, till the great battle of Clontarf in 1013, when their power was finally broken, could not have erected structures which are spread equally over the entire island. Moreover, if the towers had been the work of this people, similar structures would be found in Britain and on the Continent where they settled, or had sway; but this we know is not the fact. In opposition to this theory it was suggested in 1772 that they were remains left by a people of fire worshippers, and that they were erected to preserve the fire of the Arch-Druids, that they were also used for making celestial observations, and for other purposes derived from Eastern worship. Within the present century this opinion has received very learned support, and it has also been supposed that they were erected as places of sepulture in pagan times. This last idea is the result of excavating the foundations of several of the towers in which remains, unquestionably human, have been found. Very precise accounts of the operations have been published, but it is difficult to discover in them anything not readily to be accounted for by the fact that everyone of the round towers is planted in a graveyard of ancient date. A living writer, Dr. Petrie, has very closely examined and dismissed the theories concerning fire worship, and no analogy whatever between these towers and existing structures now or formerly devoted to it has been established. It has also been put forth that they were anchorite columns, of early Christian date, raised in imitation of the Eastern ascetics who retired to a life of solitude in a sort of pulpit forming the top of a pillar. A somewhat similar opinion in the middle of the last century held them to have been penitential prisons, and this was adopted in 1806 by that distinguished antiquary Sir R. Colt Hoare.

Of the many able and learned writers who have advocated these opinions, it may be observed that scarcely any display a knowledge of architecture, and that they had not the advantages for the study of this branch of the subject which have since been developed. We now come to a period when the knowledge of architecture was brought to bear on the enquiry. One of the first instances is found in Bell's prize Essay on Gothic Architecture, published in 1820. Then Mr. Wilkinson's work giving some particulars of thirty-two of these edifices, and lastly the laborious and splendid work of Dr. Petrie. Dr. Petrie combats most of the theories preceding his own, and contends that the round towers had a Christian and Ecclesiastical origin, and were erected at various periods from the fifth to the thirteenth centuries, that they probably united the purposes of belfries, places of strength for the preservation of relics, sacred utensils, and valuables, and that they may have been used occasionally for beacons and watch towers. At the same time Mr. O'Brien, reasoning without architecture, attempted to establish that the towers were Priapeia or Phallic emblems of Buddhist origin.

I will now proceed to speak of the general characteristics of the monuments themselves. It is admitted by the advocates, of every shade of opinion, that the towers were used in early Christian ages for belfries (some say after their original purposes were forgotten), and it is also conceded that the buildings found with them were used as churches; but a majority of the theorists have left the churches entirely out of the question. I have stated that the number of towers of which I have any information does not amount to one hundred and twenty. Of course many more must have existed in early times, and some idea of the number lost may be formed from the fact that nine have disappeared since the commencement of the eighteenth century, and that four of them were deliberately destroyed. The towers are, without exception, in immediate conjunction with other buildings standing together with them in graveyards. In the few instances in which, by lapse of time, the other buildings have disappeared, or the situation may seem to be different, it can be shown by sound evidence that these adjuncts once existed, as in the great majority of instances we still find them.

We shall presently see what evidence there is that these adjuncts were churches from the first; but at present we will assume that they were so. Usually we have on each site one church and one tower, and at places where the churches are numerous the tower still seems to belong to one in particular. Examples are to be seen at Luniscattery, where several churches still remain, Iniscailtra, and other places, which are reported to have had the mystic number of seven churches. Again, where more than one tower exists, as at Clonmacnois (where there are two towers and eight churches, or oratories, and there were more, within a space of five and a quarter English acres), and at Glendalough, where two towers still remain, and there was, till quite recent times, a third; it is still seen that the tower belonged to one church in particular.

I have determined the position of sixty-six of the towers in respect to their adjunct churches. Of these, I find that thirty occupy a position to the N.W. of the churches, twelve are placed S.W., and of the remainder, five are or were in contact with the adjunct buildings, and in most respects so exceptional that I shall not further notice them at present; the other nineteen are placed to the West, North and South; but none that I have seen occupy an Eastern position. With the omission of the five exceptional ones, all are detached cylindrical shafts tapering upwards, but not always in the same ratio. Ardmore, Co. Waterford, has the greatest taper. The shaft is diminished at the top by two-fifths of its lower diameter; the least diminution is found in the tower of Turlough, Co. Mayo, the taper being in this case scarcely more than one-eighth. Some of the towers retain part, or the whole of their original roofs of stone, brought into a conical form by corbelling over, so as to form, when entire, as nearly as possible an equilateral triangle in section. The highest towers have not the greatest diameter. Fertagh, Co. Kilkenny, is the highest; it is 100 feet to the commence-

ment of the roof, which, when perfect, must have raised it as nearly as possible to 111 feet, the diameter at the base is 15 feet 8 inches. Kilnasduagh, Co. Galway, the next in height, and still nearly perfect, is 96 feet 8 inches to its cornice, and 100 feet complete, it is 18 feet 6 inches in diameter. Turlough, which is only 62 feet 6 inches to the cornice, and has the roof nearly perfect, was 74 or 75 feet complete, and is 18 feet diameter. This is much below the average height of the perfect ones remaining; but there is one on Tory Island, in the Atlantic, six miles from the coast of Donegal, which is only 40 feet high to the cornice (it must have been 51 or 52 feet when complete), and is 16 feet 4 inches in diameter at the base. This is the least altitude, and it may have been adopted from the severe trials by tempests to which its peculiar situation on a solitary rocky island would expose it. Many of the towers spring from a plain plinth, which rises 2 to 3 feet above the ground, sometimes in two steps. The entrances are invariably raised considerably from the ground; that at Kilnasduagh so much so as to be seen above the walls of the ruined cathedral when viewed at a distance from the building. In this instance the height is 20 feet, usually it is not less than 10 feet. In some, entrances have been made at later times at the ground level, but they are easily to be distinguished from the original ones. The entrance always faces the church, where a church of corresponding construction is co-existent, churches of later date have been erected without regard to the facing of the tower door. The form of the entrance door has only two varieties, the semicircular arch and the flat head. the first of these is found three times in four in forty-three existing examples. All openings, both for doors and windows, have the jambs inclined so as to contract the openings at the top, but the jambs are parallel on plan *i. e.*, without any splay; many of the doorways, however, have a reveal on the inside for a door. In some cases means are provided for securing the door by a bar let into projecting stone sockets; these could only be used by persons inside the building. In one case there is provision for two bars. The hinges seem always to have had iron hooks let into the stone, but in almost every instance these hooks have been removed by violence. Of the arched doors, the dimensions of that of Glendalough, Co. Wicklow, may be taken as an example. It is 2 feet wide at the bottom, 1 foot 9½ inches at the springing, and 5 feet 8 inches high to the crown of the arch. Of the flat-headed doors, Lusk, Co. Dublin, is 2 feet 1 inch wide at the bottom, 1 foot 9½ inches at top, and 5 feet 11 high. The variation from these dimensions in other examples is very slight.

In the interior the towers were divided into stages; in a few instances there are very slight traces of these stages or floors, but usually a sailing course of stone, or a set off in the walls formed a roof for the floor. Only three or four ancient floors remain, and three of these are formed by a very flat arch or dome of rough stone grouted with mortar rising less than a foot. The fourth is made of slabs of slate, but I am not certain of its antiquity. Taking seventeen examples of perfect, or nearly perfect towers, we have six divided into eight stages, seven into seven, three into six, and one (that on Tory Island) into four. One tower, Donaghmore, Co. Meath, now imperfect, seems to have had nine stages. The ground stage, or that below the door, is sometimes filled up to the door, but I think it was never built solid so high, though it may have been solid for 3 or 4 feet above the ground. This story is generally vacant, and only one instance, Ballagh, Co. Mayo, occurs of a light in it. This is a circular hole on the outside, 6 inches diameter and spined on the inside to 1 foot 4 inches wide, with inclined jambs 9 inches high, and a flat segmental head cut in a single stone. The second, or door stage, has in a few cases a window over the door. The other stages, except the top, have one window each, and the only rule followed seems to have been to place them at from 8 to 15 inches from the several floors; thus, from the small size of the windows, the upper part of each apartment was left almost in darkness. Instances occur occasionally in which a stage has no window. Two instances

are found with eight windows in the upper stage, both of these however have been altered from their original to their present state. Among the pure examples two have six windows at the top; one has five; and all the others four, facing the cardinal points very nearly, but a distinct variation from that direction can be detected in one or two cases. The form of the window heads has three varieties, semi-circular, flat and angular, the last such as are considered in England usually, though not always, to indicate work of an age before the Norman Conquest. Sometimes a window has one of these forms on the outside, and another on the inside. When a window occurs over a door, it is the largest in the tower, and approaches the door in size, otherwise the top windows, except in one or two examples, are the largest. Those of Ardmore, which unite the arched and angular form in the heads of three of them, are 1 foot 5 inches wide at the sill, 1 foot 2 inches at the springing, and 3 feet 5 inches high to that point; the sill being 1 foot 8 inches above the floor. The fourth window is flat headed. These are fair general examples for size and position. The windows in the various intermediate stages are smaller; a window 1 foot wide at the bottom, 10 inches at the top, and 2 feet high, is a fair average, placed, as before observed, very close to the floor, with very few exceptions. In only one example is there ornament on the windows, but many of the doors are more or less decorated. The material employed is always that of the locality; in the North basaltic rock, granite, whinstone and slate; in the central districts limestone of various qualities, but always hard. The only building of colito is Killala tower, which is constructed of a very hard dark grey stone, and stands on a rock of the same. One of the towers in Mayo is built of sandstone, although within the limestone district. In the South sandstone is the prevailing material; but towers situated amidst slate rock are built of slate, and granite is used under similar circumstances. When the native rock is not suitable for chiselled work, sandstone and granite have been introduced for the doors and windows.

The decoration of the doorways is usually of a very simple kind. Of twelve with flat heads, only two have any ornament. Lusk, one of these, has a flat band, or architrave, extending all round the face, but apparently never finished. Antrim, the other one, is hereafter described. Most of the others have wrought masonry, but the beds are not parallel, and the stones are curiously notched and fitted together; others consist of rudely hammered stones. The walls of the towers are 3 feet 6 inches to 4 feet 6 inches thick, and it is not uncommon to find the jamb-stones of the same thickness. The head and sill are frequently in one thorough stone, six or seven feet in length, and of proportionate thickness. Of thirty-two arched doorways, sixteen are without ornament; of the others, four have plain flat architraves all round. One (Kells, Meath) differs only in having had a human face in relief on one jamb, and a small block left for carving on the other; another, Monasterboice, Co. Louth, has the centre of this band architrave sunk out, the sinking stopped at the springings and the centre of the arch, which is constructed with horizontal instead of radiating joints. Aghavuller, Co. Kilkenny, has the band relieved by a single groove near the outer edge of the face. Cashel has a plain architrave on the face, and a plain blocking impost running through the doorway at the springings. O'Ruark's Tower at Clonmacnois, King's County, has an impost and not an architrave. The first approach to enrichment is in the very well wrought doorway of Ratoo, Co. Kerry, which has a plain architrave, and a curious scroll in very low relief over the head. Donaghmore, Meath, is one on which the advocates of a Christian origin have greatly relied for support: it has a band architrave, with a bead on each edge, and is remarkable for the sculpture of the Crucifixion on the keystone, with a human head on each jamb. There is a total of ten of this class of architrave with the round arch as compared with one example only of the flat head. The remaining five ornamented doorways are at Antrim, Dysart, Kildare, Timahoe, and Ardmore. Antrim is one of the quadrangular doorways, and only remarkable for the cross in relief over the head, which, from its style of execution, is evidently coeval with the

tower. The latter is built of basaltic rock, but the doorway is made of large blocks of porphyry well wrought. Dysart, Co. Limerick, has a band architrave projecting four inches instead of only one, it is moulded except the sill; the head is further enriched with pellets, or spherical ornaments in the centre of the moulding. This tower is of limestone, but the doorway is of a red sandstone of inferior quality, and it has suffered greatly from time and violence. Kildare and Timahoe are remarkably enriched with zig-zag and sculpture in very low relief; the capitals and bases of the jamb shafts are very singular in design. Timahoe (Queen's County) is quite perfect, but Kildare has been greatly mutilated externally; it retains, however, a peculiar feature in the remains of a gable canopy over the head of the doorway outside, and which is unquestionably original; both are constructed of sandstone, which also enters largely into the construction of both the towers. The last to be noticed is the doorway of Ardmore, which has merely a large head on the angle of the head and jambs, and a flat projection on the face of the sill, in which it has been supposed that the two channels were caused by the wear of bell-ropes passed out of the doorway, and pulled from the ground; but I believe they are marks made by placing a ladder against the tower as an access to the door. This tower is remarkable for three string courses of torus moulding, which are placed without relation to the divisions of the internal stages; the apex is shown in several prints of the last century, with a cross or finial upon it; whatever it was, it has disappeared. The material is a very good sandstone, wrought in regular ashlar, and in very good condition. Another singularity is that in several of the stages, which in most other towers are furnished with one or more rude projecting corbels, placed quite irregularly, the corbels are variously sculptured. The whole of the interior is as carefully finished as the exterior.

Another tower to be specially noticed is Devenish. The doorway has been already included in the four with plain banded architraves; on the apex is a stone of a swelling shape, as if it were the base of a finial, and I have seen it described as possessing at one time an ornament likened to a crescent, which was doubtless an imperfect finial. At the base of the conical roof, where in all the other towers there is a plain projecting blocking or sailing course, there is a richly wrought band with four human faces. It is impossible to speak too highly of the execution of the masonry of this tower; it is wholly in sandstone, of an exceedingly rich and warm colour, and although the beds and joints are not parallel, and the courses are consequently irregular, the whole is fitted together with the greatest accuracy. The Tower of Swords, Co. Dublin, still retains at its summit a small plain stone cross, but not the original finial. About eighty years ago the tower was very injudiciously repaired, and the present cross erected, but the old one taken down, of which it appears to be the counterpart, is pointed out at the head of a grave in the churchyard. I have elsewhere seen at the foot of a tower the summit stone of the fallen roof, morticed to receive a finial. To conclude the detail of the towers we have only to notice Kinnel, Co. Cork, which is hexagonal in plan to 2 feet above the door, where the form changes to the usual cylinder, having the haunches at the angles of the hexagon finished by pyramidal weatherings.

The construction of the walls, as might be expected, depends greatly on the nature of the stone used, and the facility of working it. It is, in some cases, wholly of rough stone and uncoursed, whilst in others the stones, though undressed, are ranged in courses; in these instances the material is granite or other plutonic rocks. The greater number of towers are of coursed work, in which very large stones have been chopped or chiselled to the curve on the face, but the beds and joints are unwrought. Near the base of the tower it is not uncommon to find stones 7 or 8 feet long, and even longer. This construction is usually of limestone, and the best example, shewing great accuracy in the fitting together, is seen in the Tower of Kilmacduagh; others are of sandstone, and a few of the harder rocks. In another class the stones are jointed as well as faced, but not worked to parallel sides and joints.

Examples are found at Aghadoc, Co. Kerry, Dovenish, Co. Fermanagh, Cabel and two or three other places. A still more advanced style of work is the ashlar in squared courses, found at Ardmore and at Clannacnois. These two last classes are executed in sandstone.

In connection with sixteen of the existing towers, or where there is undoubted record that they once existed, are churches exhibiting in their doorways, windows and walling, the same peculiarities as the towers. The doorways are flat-headed, the jambs incline inwards, and the flat band architrave is found on the face. The windows are exceedingly small, flat angled and round headed, but differ from the tower window in being splayed inwards; usually having an arched head on the inside, but sometimes a flat one. The jambs are inclined like those of the doorways. Where these characteristics are wanting, I have found nineteen instances of decidedly Romanesque churches, the character exhibited by the zig-zag and other ornaments common to the style which throughout Western Europe arose with its present chief monarchies and divisions; the remainder belong to the *era* of pointed architecture, which, I am inclined to think, was not practised in Ireland till after the first irruption of the English, A.D. 1167. At this date pointed architecture in England was just emerging into a distinct style: Salisbury Cathedral was not commenced till fifty-three years later, but the pointed arch had appeared in union with Norman characteristics in Dunstable Priory, erected A.D. 1181-1185, and was so used still later in the circular part of the Temple Church, dedicated A.D. 1184. At that period circular belfries had been erected in England. Mr. Hudson Gurney examined above fifty mostly in Norfolk and Suffolk, and found others in Cambridgeshire, Essex, Sussex, and Berkshire. He found them to be chiefly of Romanesque architecture, but also of the various dates of the pointed styles, assigning only to one a date earlier than the twelfth century. Though earlier than any he described, the curious circular turret at Brixworth was not mentioned by him. There can be no doubt of the correctness of Mr. Gurney's conclusions. These English towers have nothing in common with those of Ireland except their rotundity; they are always attached to the churches (generally at the west end), and opened to them by means of an archway; but there is usually no doorway in the tower. There are frequently many windows in each story. In these particulars there is no analogy, nor is there in the dimensions; the highest being only 56 feet, whilst the usual diameter exceeds that of the largest of the Irish towers. In Scotland, however, two examples are found precisely agreeing with the Irish, at Brechin and Abernethy, both on the east side of Scotland, and consequently most remote from Ireland. It is now well ascertained that the Scots were an Irish people first established in Caledonia in the third century of the Christian era. At the beginning of the sixth century the colony became a kingdom of small extent on the Western side of the present Scotland, and in 843 finally mastered the Picts, and henceforth included the whole of the North of this island. It was not therefore till 843 that the two places on the East coast where towers exist came into the possession of the Irish: hence may be found a reason for assigning a date after this period to those two towers; but it is by no means conclusive, for a church had previously existed at Abernethy, which was the metropolitan see of the Picts, whence it was removed to St. Andrews by the first Irish sovereign. Still it can hardly be doubted that these two edifices are purely Irish, since it was from Irish missionaries and the Apostle of Ireland and Scotland, St. Columbcill, that the Picts obtained Christianity, and in the Irish annals there is the record of a church at Apur-Crossan (now Applecross in Ross-shire), erected in Scotland in 671 by an Irish ecclesiastic. There are remains of an ancient church here existing to this day. Other churches were of course built by the same people, and it is likely that other towers have also existed.

To the Irish then it seems these towers are peculiar, and to Irish history we must resort for records of them. The mention of them in ancient annals is rare. They are there designated by a

name which Dr. O'Donovan and the best Irish scholars of this day agree in translating as "bellhouse," although advocates of the Pagan theories have attempted to give it a different meaning. It is not necessary to enter into this question. I need only say, that according to the earlier translations, the word was understood to mean and was translated "steeple," by those who had no theory on the subject to favor or maintain. Dr. Petrie has demonstrated the errors of others and explained his own views in support of this interpretation. Giraldus Cambrensis who went to Ireland in 1185 in the train of Prince John, afterwards King John, and returned to England in 1187, has been referred to by all writers on the subject as the first foreigner who noticed the round towers. In his topography of Ireland, when describing the supposed origin of Lough Neagh, he remarks—that an ancient inundation had submerged the extent of country covered by it, and that this tradition was supported by the natives on the ground that they could still see beneath its waters, those ecclesiastical towers, which after the manner of the country, are narrow, lofty and round—"turres ecclesiasticas quæ more patriæ arctæ sunt et altæ, nec non et rotundæ." This notice and another by the same writer, first pointed out by Dr. Petrie, in which by the same title, *ecclesiastica turris*, he speaks of a tower at Kildare, where a round tower still exists, and relates a tale concerning a hawk which was believed to have inhabited it from the days of St. Brigit, shew that at the coming of the English into Ireland these structures were regarded as ancient. It may help to limit this antiquity to know that of the sites which now possess them, or did once, a great number can be traced to have been occupied by churches or ecclesiastical establishments founded after the arrival of St. Patrick, the great apostle of Ireland. He arrived in 432, when, although Christianity was not unknown, the prevalent religion was a system of Druidism very similar to that which Julius Cæsar had found in England. Before the death of St. Patrick, the greater part of the population had with extraordinary alacrity embraced the new religion, which required for its rites buildings not necessary but useless for the religious rites of the Druids. In cromlechs, pillar stones and similar monuments, not peculiar to this island, we have abundant evidence of the pre-existent religion, besides the records preserved in the various annals composed in the early ages of Christianity. Of less than 120 sites with which we are more particularly concerned, it is on record (as far as I know at present) that ten of them had churches or ecclesiastical establishments founded in the first century of Irish Christianity. In the succeeding century, from 500 to 600, I find eighteen of these sites of which similar foundations are recorded, or when it is then first ascertained that such buildings or establishments existed. From 600 to 700, nine new foundations; from 700 to 800, four; from 800 to 900, seven, of which probably only three were founded so late as this. In the two following centuries, I find only one place appearing on the list for the first time; but 1100 to 1185 brings five places, which, though then making their first appearance, were with respect to four of them older foundations, and the fifth, which was new, is one of the five places whose attached tower we set apart at the commencement for distinct consideration. We thus see that of 54 sites of these round towers, 28 had ecclesiastical establishments before the expiration of the century following St. Patrick's arrival. The others had them at various periods down to probably the year 1000, or a little later; further research, would of course, add to the list. Of the round towers themselves under the term corresponding to "bellhouse," the earliest notice which Dr. Petrie has found is of the year 948, which records the burning of Slane steeple, a steeple which has long ceased to exist. In 964 is recorded the death of an ecclesiastic who had built the church and steeple of Tomgraney, which it is also recorded was repaired by King Brian Boroin, who lost his life in the great battle of Clontarf, A.D. 1013. This steeple is gone but the church remains. The next notices are in 906, 1020, 1039, 1050, recording injuries by accident or violence to these steeples, one being twice mentioned with the destruction of its bells. None of these towers now exist,

but the records of 1076 mention the death of a chieftain in the steeple of Kells, where he had taken refuge, by the hand of a rival chief. In 1007, the injury done by fire to the steeple of Monasterboice, (now existing), with its books and treasures, is mentioned; in 1121, a tower previously noticed, had its conical cap blown off; and in 1124, the finishing of the steeple of Clonmacnois is described; this again in 1135, had the head or conical cap struck off by lightning, and in the same year another was injured by the same means, this still exists in an imperfect state. In 1127 and 1147, we read of steeples which do not now exist struck by lightning or burnt by marauding forces. Then in 1156, Fertagh steeple (still existing), was the scene of a murder. In 1170, the steeple of Ardbraccan fell. In 1171, another (now no longer existing) was burnt, filled with people who had taken refuge in it from their enemies. These notices mention fourteen round towers between 948 and 1171, of which five still remain. The conclusion that they were all round towers can scarcely be avoided. So far as I have seen or heard, there is not in existence a square belfry of so early date. That they also contained bells is clear; indeed at Clonmacnois, the bells remained till the place was pillaged and ruined in 1552. The earliest square towers which I know are the two occupying the position of transepts in the remarkable church called Cormac's Chapel, on the Rock of Cashel. This church was erected between 1101 when the King of Munster gave the site to "God and St. Patrick," and the year 1134, when the consecration of the church is recorded. From it we may now endeavour to arrange in a chronological order the materials before us, only referring to one notice of later date, 1238, where it is recorded that the steeple of Annadown was erected. Nothing remains to show whether this was a square or a circular belfry. It has usually been assumed that it was circular.

Cormac's Chapel, finished about 1134, consists of a nave and a chancel, with a recess for the altar, and two towers placed as transepts. The nave has a barrel vault with hoop ribs, but the chancel is groined. The whole is roofed with stone, carried on an upper vault constructed on the barrel principle, but pointed, and the space between the vaults contains two apartments, one over the nave provided with a fire-place, the other over the chancel. Stone stairs in the south tower give access to these crofts, and the north tower contained a series of timber floors, all of which are destroyed. The whole interior of the church is only about 47 feet in length. The general character of the work is at once seen to be different from and of later date than that of the round tower at the same place. Another church, that at Aghaloe, where the stump of a round tower remains, is recorded as finished in 1158. Of the original church, the only feature remaining is the beautiful west doorway, which serves to confirm this position. At the beginning of the preceding century, Brian Boroim was monarch of Ireland; he died A.D. 1013. It is recorded that he repaired the steeple of Tomgraney: the prelate who built this very steeple and the church of Tomgraney (in the County of Clare), died in 964. Traces of the steeple are said to have existed some forty years ago. The church remains and is used to this day. The plan is a simple parallelogram, 84 ft. in its extreme length, and 28 ft. in width. The building exhibits two distinct periods of work; the western portion being of the irregular coursed masonry in large stones seen in many of the towers, with buttresses projecting westwards in a manner unused in any of the later buildings, and in the west end a flat-headed doorway of the design which frequently occurs in the towers. This doorway is 6 ft. 4 in. high, 3 ft. 1½ in. wide at the top, 3 ft. 6 in. wide at the bottom, and constructed in six stones all going through the wall. The eastern portion is of well wrought and squared ashlar, the angles ornamented with shafts with well carved capitals and bases. The western portion I consider to be a remnant of the church erected before 964, unless it be shown to have belonged to a church known to be here 200 years before that time, and the eastern was probably the work of a later date, perhaps of the time when King Brian repaired the steeple. This conjecture is supported by the remains of a church on the

island in Lough Derg, called Holy Island, or Inniscaltra: it is visible from Tomgraney, and contains several churches and a round tower. The principal church 45 ft. from the tower, has likewise work of two distinct dates. The nave walls and one small window are of the more ancient description, but the other window (distinctly an insertion), the chancel arch and west doorway, are of a later date, as well as the chancel, which is of square ashlar. It is recorded that this church was erected by the same King Brian, whilst we also know that a church was founded here some 250 years before, which was plundered and burnt more than once by the Danes. We may therefore conclude, that King Brian used as much as he could of the old walls, and that the chancel and ornamental features noticed, were his work. We shall then without difficulty give the same date to the east end of the church at Tomgraney, and a previous date to the early work of the church and to the round tower at Inniscaltra. A little earlier than the record of the erection of the tower and church of Tomgraney in 964, is that of the cathedral at Clonmacnois, built by an abbot who died in 924. The principal mark of its early antiquity is found in the peculiar buttresses at the ends. Almost the only other feature of an early date remaining, is one capital with the jamb of the west doorway. At the same place there are two remarkable sculptured crosses and the remains of a third; one of the three is sculptured with subjects, some of which are readily identified as Scriptural, and it is shewn by ancient Irish inscriptions upon it, to have been erected as a monument by the same Abbot Colman who erected the cathedral to the then reigning sovereign of Ireland. Clonmacnois was then, and had been from its foundation by St. Kieran about A.D. 544, one of the most important religious establishments in Ireland. Of its early celebrity as a place of sepulture, there is existing evidence in the forty ancient inscribed and ornamented gravestones, many of which bear the names of abbots and bishops, and others who are elsewhere recorded to have lived in early times. The earliest I have noticed thus identified is of the date of 724, and the latest 1026. Of the other churches, two are distinctly as old, and probably older than the cathedral. There are also the two round towers, one which was mentioned as finished in the year 1124; the other is attached to St. Finian's Church. The crosses are also mentioned in ancient records; first in 918, then in 937; then in 1060, one of them, doubtless the one to which a date is assigned above, is called "the Cross of the Scriptures," and lastly in 1070. Near the site of another of the round towers at Monasterboice, stand three crosses, two richly sculptured, and one bearing an inscription, from which it may reasonably be assigned to the same date as Abbot Colman's. At other sites crosses are mentioned in the annals of 847 and 1106. All considerations united, there is good ground for supposing the principal of the two round towers at Clonmacnois to be at least as old as the cathedral, and I incline to think it older, which is I believe the case with the little oratory or church which bears the name of the founder St. Kieran.

At Glendalough, in addition to the great round tower, there is one of the attached round towers, which, it may now be observed, corresponds in its architecture with the others. It is placed on the barrel vault of St. Kevin's church. Originally this building was a simple parallelogram, 22 ft. 6 in. by 14 ft. 6 in., internally, covered by a semi-circular barrel vault, and roofed with solid stone of slate rock carried on a pointed barrel vault, an apartment being formed between the vaults. To this a chancel was afterwards added, which has wholly disappeared, the groove only being left in the end of the nave into which the chancel roof fitted. This shews that the chancel did not bond with the nave, the same is also the case with the sacristy still standing, and which was coeval with the chancel. The original east window is still visible, though blocked up in the end wall of the nave, and partly destroyed by the opening for a chancel arch which was made by merely cutting out the wall without inserting any voussoirs, the courses running out horizontally to the edge of the circular-headed opening.

Corresponding in its character with these additions is the round tower placed at the west end of the church, and measuring only 39 ft. 10 in. from the ground to the base of its cone. The quadrangular door, with a discharging arch like that of the cathedral, and other features, attests the antiquity of the building. The burning of this church is reported A.D. 1163. Another of the exceptional towers was attached to the church now called Trinity Church, at this place. The tower was standing at the end of the last century, but now only a fragment of the base remains, containing one small and very early window. The antiquity of the church is attested by the quadrangular west doorway which opened into the tower, and other features. The tower was square at the base and cylindrical above. Another tower, square at the base and circular above, exists at Killashee. It was from the first attached to the west end of a church, and had an opening into it formed by a large semi-circular arch of unbewn stone. The existing church is modern. The features of the tower display the marks of great age, but are in many respects peculiar. Built into the walls is a piece of wrought and moulded stone of early date. On the whole this was probably a late erection of the kind, but a church existed here from the very earliest introduction of Christianity, the founder of which died in 400.

The fourth attached tower is that of the Church of St. Finian at Clomacnois. It stands south of the chancel, with an opening to it through a semi-circular headed doorway with inclined jambs, placed at the level of the chancel floor. Some of the windows are slightly recessed on the outside, it has not the four windows at top which are seen in other towers. The masonry is in parallel courses, and is bonded to, and corresponds with that of the church. The tower is only 45 ft. 3 in. high to the cornice, and 11 ft. in diameter. The conical roof is much dilapidated, but the peculiar arrangement of the stones with herring bone joints can still be detected. The church is coeval with the tower, and has a very rich chancel arch with zig-zag and other ornaments. The only historical evidence I know is that from the annals, shewing that it existed in 1015. The fifth attached tower was at the church at Dungiven, and had an erection called a round tower at its south-west angle, known to me only by two inferior prints. It fell in 1784. The church was founded about the year 1100, and has some interesting remains of that date, but it was extensively altered in a later style of Romanesque work, and again in both the first styles of pointed architecture; from all appearances I think the round tower was only a small turret set on the south-west angle of the nave, and that it was not coeval with the first church. I ought perhaps to allude to two others which have been called round towers, but which were evidently not of the same nature. Trummery Tower in the County of Antrim, fell about 25 years ago. It was attached to the north side of a building which does not seem to be old, but occupies the position of chancel to a ruined church. The remains are mere traces, from which I could not attempt to define dates, but the published drawings and descriptions of the tower shew it to have been very small as compared with others; and it is evident from the lower steps of a spiral stair of the rudest construction still remaining, that it was a stair turret. In this it agrees with the remaining one at Tamlaght-Finlagan, in the County of Londonderry, where the commencement of the stairs also remains. This one was square at the base, and attached to the north side of the church at its west end; the fragment is only seven or eight feet high. The building is known to be as old as the era of pointed architecture, to which I think it belongs, but a church stood here in the seventh century. The broken walls which remain do not indicate the date with any certainty.

I must just revert to the ornamented tower doorways at Timahoe, Kildare and Dysart, in order to remark, that having seen that ornamented architecture was in use about the year 1000, and judging by the sculptured crosses and some other remains of still earlier date, there is good reason to suppose that these doorways are only enriched specimens of the earliest era. The shape of the opening, the low relief of the carving, and the peculiar caps and bases, shew such a difference between them

and the enriched specimens established to be of later date, that it seems to me we cannot be mistaken in giving to Timahoe a date as early as 880, at which time I first find mention of an abbot of the place; and to Kildare (which we know from Giraldus Cambrensis was reputed an ancient building in his day), at least an equal antiquity. Dysart doorway is probably older, as the ornament is only a slight advance on the hand architrave.

We have seen that arched doorways prevail in the greater number of towers, and it might be expected that doors of the same form would be found in the associated churches of the same period. It is curious, however, to notice that in every instance where we have the coeval church and tower, the tower doorway is arched and the church doorway flat-headed. Churches with arched doorways with inclined jambs do exist, and probably of equal age with the others, but I have never seen such doorways belonging to churches in association with round towers.

One of the purposes for which the towers were constructed may account for the destruction of many. We have seen that they were resorted to for defence and security, and that they were intended to be so evident from the means used to fasten the doors inside, and from the position of the doorways at a height above the ground. To this it has been objected, that their inside diameter (not more than 8 ft.), is so small that they could not contain any number of persons. It may well be supposed that they were more especially intended for the clergy, with relics, books and valuables which would not occupy much space, but some of the numerous floors would be available for other people. It is only lately that a gentleman who has not favoured this view, has published an old account of a siege of one of these towers which took place so late as 1642 at Ardmore. The castle adjoining the church-yard and the round tower were held by a force, of whom 11½ men with 183 women and children were in the castle, and 40 men in the round tower. The castle was reduced when threatened by a piece of artillery, and afterwards the 40 men with two muskets who held the steeple submitted. This fact shows how serviceable the building would have been in earlier times, and this use of them may account for the position of the windows in the shaft being so near to the several floors, as it would expose the assailants when near the building, while the facing of each of these windows towards a different point of the compass would be another aid to the defenders.

The facts before us seem then to show, that from the ninth century down to the age of Cormac's chapel, ornamented architecture, partaking of the character of the Romanesque of other countries, was practised in Ireland; and that this style, modified by the extensive intercourse which it is known was maintained by the Irish clergy with the continental nations, had arisen out of a state of the art peculiar to the country in the centuries between the fifth and the ninth, but common in many points to the efforts of other nations in the infancy of the art of building with stone;—that for the origin of this phase we must look to the builders who had the skill to raise the massive stone forts of which some remain to this day, whose antiquity is historically certain; and that as there is no doubt that many of these forts were the work of the Pagan ages, it is also likely that their construction without mortar may have been afterwards continued, although mortar then came very generally into use, and the round towers and their churches are all built with that material.

From this survey and review, we may, I think conclude, that the round towers and the churches coinciding with them, rose with the foundation of the establishments recorded in the early ages of Christianity, and that as those foundations belong chiefly to the era between 432 and 700, we shall not err in supposing that the round towers and corresponding churches belong nearly in the same proportion to that period, but that others date their origin nearly as late as the year A.D. 1000.

Mr. GODWIN, Fellow, considered it a matter of great regret that the architectural antiquities of Ireland were not better known and more studied by young English architects. He had never been more impressed with any architectural scene than on his first visit to Ireland, when he saw a beautiful group of churches and crosses, with a round tower in the centre, at Monasterboice. These objects were met with quite unexpectedly in the midst of extensive tracts of country. At Monasterboice there were the ruins of two or three churches and two or three crosses, one of them 23 or 24 ft. high, and towering above them all, in the centre of the group, was the wonderful round tower shown in the drawings. The effect of that tower, when the spectator stood at the foot and looked up and saw the clouds sailing rapidly across the top of it, was most extraordinary. Some of Mr. Hills' drawings shewed very well the connection which existed between the modes of architecture adopted by all the early nations of antiquity. In the Irish round towers there was seen a pelagic character in the openings in the masonry; the same was displayed in the mode of covering many of the mounds, of which no mention had been made by Mr. Hills, and in which the passages were covered by stones projecting one over the other and ultimately closed by one stone, as was the case in the earlier Treasuries and ancient buildings of Greece. In looking at the drawings he found another illustration of the fact, that all architectural forms have been arrived at step by step; and they served, among other instances, to caution the profession against the possibility of arriving at once at a new style of architecture. The mound of earth, or the few stones which were thrown over the grave by all the early nations, formed, no doubt, the germ of the Egyptian pyramids; and some writers had thought that the germ of the finest Greek temple, in all its purity and elegance, could be traced in a simple altar stone. It appeared to him that the Irish round towers were merely an elaboration of the simple pillar of memorial, or stone of memorial, which had been employed from the earliest antiquity, and was mentioned in the Holy Scriptures as one of the first things raised by the children of Seth. The pillar of Tara which had been alluded to by Mr. Hills was one of the same kind; and there was another at Rudstone, in Yorkshire. Without however entering into any dissertation on the origin of these interesting monuments, the object he had in rising was to move the thanks of the meeting to Mr. Hills for his valuable paper; and he would also take leave to propose the same to Mr. M. Digby Wyatt for the interesting description he had given of the Crannogee, which displayed a species of construction very little known, and took them back to very extraordinary state of society.

To an enquiry respecting the material of which the floors of the towers were constructed:—

Mr. HILLS explained that he only knew of three stone floors now existing, and all of them were imperfect. They were in the form of very flat domes. He believed the floors were generally of wood, borne upon projecting sailing courses, and the fact of their being of wood, accounted for the frequent notices in ancient records of the burning of these towers.

Mr. M. DIGBY WYATT, H.S.F.C. observed that one of the points which had been referred to was particularly interesting, namely that the door of the Round Tower was turned in the direction of the church, shewing that there would have been some communication between the one and the other, by which the priest might be able, in times of great danger, to remove from the church the valuables which it contained, and the relics of the saint, to the upper part of these towers, which was, no doubt, a place of refuge and defence.

Mr. DONALDSON, H.S.F.C. observed that the doors were not always turned towards the church.

Mr. HILLS thought there was no exception.

Mr. DONALDSON said, it was not the case at Kilkenny.

Mr. HILLS said that the church there was much later. He believed, indeed, there was no

exception to the rule. Whenever the church was coeval with the Round Tower, the door of the tower faced the church. The church of Kilkenny was of much later date than the Round Tower. It was built shortly after the coming of the English, and all vestiges of any older building, excepting the tower, had disappeared.

Mr. FRASER, C.V. said that his own observation of these antiquities had led him to believe that the churches generally were of later date than the Round Towers, and that the churches were built to the towers, and not the towers to the churches. He should be glad to know if Mr. Hills had come to any conclusion as to the original intention and purpose of these towers. Perhaps the circumstance of the windows being placed within 8 or 10 inches of the floors might illustrate this; at all events, it was a very interesting question whether these towers were monumental, whether they were erected for the purposes of defence, or as light-houses, or bell-towers. It was true that bells might have been adapted to them, but he did not think they could have been originally intended for bells.

Mr. DONALDSON said that in a tour which he had made in Ireland three or four years ago, he had come to the conclusion that these towers were really bell-towers and originally attached to churches. As Mr. Hills had explained, they had some of them six openings, and others eight openings, at the top; and he had no doubt that the priest had a hand-bell which was rung outside these openings. Large bells were not necessary. In Greece, for instance, the congregations were called to church by striking an iron bar, as bells were forbidden. He also believed that these towers were places of defence and refuge, and for the preservation of treasures, as, indeed, even the old churches in Ireland were, because the parapets of the roofs and of the towers were crenellated.

The Chairman, Mr. J. J. SCOLLS, V.P. inquired why Mr. Hills supposed the towers were originally bell-towers?

Mr. HILLS explained that the term by which they were described in the ancient records signified "bell-house," and this meaning was well established by the best scholars of the day. There were no ancient bells remaining in any of these towers at present, but some of them still contained some bells of modern date of considerable size. They were certainly well suited for bells, and the small hand-bells which Mr. Donaldson had alluded to had been found in connection with many of them.

Mr. DONALDSON sketched one of the small hand-bells, of which several specimens of very ancient date had been discovered in Ireland, some very highly ornamented.

The CHAIRMAN inquired of Mr. Hills whether he thought that the circular form had been adopted for these towers for any particular reason, such as insuring greater strength, or on account of the nature of the material which was employed. In Norfolk and Suffolk there was an absence of freestone, and, in fact, there was nothing but flint to be got in the neighbourhood, and this material appeared to have led to the adoption of the circular form for the towers of those counties.

Mr. HILLS said that the circular form had certainly not been adopted in Ireland to suit the material, because a great deal of trouble had been taken to work to the curve the stones which were used, and in working the large stones of 7 or 8 feet in length, which were often employed, a great deal of labour must have been incurred. He thought that the reason for the circular form was its strength and durability; and that this form did possess such durability was, he thought, fully proved by the fact of the great number of Round Towers now existing, whilst there were so very few Square Towers even of much later date.

After the votes of thanks to Mr. Digby Wyatt and to Mr. Gordon Hills, the meeting adjourned.

AN ACCOUNT OF THE NEW PALACE AT WESTMINSTER, AND THE PROGRESS OF BUILDING THE SAME.

By EDWARD M. BARRY, Associate.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, Feb. 1st, 1858.

I have undertaken to give some account of the New Palace at Westminster, or, as it is more commonly called, the New Houses of Parliament, and the progress of building the same, but I very much wish that this could have been done by the only person competent to do it. Seeing, however, that this unfortunately cannot be, I must appeal to you for that indulgence which is seldom refused to those who endeavour to do their best. The disadvantages of discussing in this room the works of living architects are obvious, and by no means inconsiderable, but there are also special reasons why to do so occasionally may be desirable. The objections alluded to chiefly apply when any detailed criticism is attempted, or any one-sided endeavour made to forestall the calm judgment of posterity. On the other hand, many details, both of progress and design, can be best treated of when they are fresh in the mind and not effaced by the lapse of time passed in the practice of an absorbing profession. My province to-night is a very humble one. Criticism in the present case would only be an impertinence, and I propose simply to describe a few of the steps taken in the erection of the largest public building of our day; to indicate a few of the difficulties with which the architect has had to contend; and to give some general description of the structure which has been his constant anxiety for nearly twenty years. An architect is under great disadvantages in carrying out his views, when compared with his fellow artist the painter or sculptor. These for the most part design and elaborate their conceptions in the retirement of the studio; they acknowledge no master, are only subject to the restraints their vehicle imposes on them, and seldom submit their works to criticism until they have made them perfect to the best of their ability. An architect, on the contrary, works under an universal censorship; he is controlled and hampered when he is often considered most free, and his works are invariably judged by the experience of parts which are often the least important portions of his design: I say nothing here of cases where his conceptions are never realized, for my hearers must know too many cases of disconsolate churches linked to headless towers to need to be reminded upon this point. Architects again are peculiarly exposed to that species of cheap criticism, which consists in calling names, and of which we have now too many examples, while, above all, their errors once made are perpetuated without power of recall. They are also incessantly liable to attacks which they have no opportunity of resisting, and public bodies too often appear to find the process of condemning an absent and unheard architect a pastime, as pleasant as it is unquestionably safe. I do not say this with a view of in any way depreciating fair and genuine criticism in architectural works; on the contrary, I think there is far too little of it, and am quite sure that an architect may always benefit by its free expression; as regards the present instance, I am firmly convinced that the New Palace at Westminster, as it stands with all its excellencies and defects, will hold its own against most assailants; but I do think that if an architect's position were fairly considered, we should have something more of calm enquiry, and something less of that trenchant declamation into which so-called architectural criticism seems so apt to glide. A building like the New Palace at Westminster, which is not only the seat of the two Legislative Chambers, but is also the greatest Public Office in the country, must in the nature of things attract considerable attention, and it has therefore been thought that some description of it might not be

uninteresting to the Members of the Institute. Before however I proceed to describe the building as it now exists, it may perhaps be desirable to dwell for a short time on the preliminaries to its erection.

Many of those present will be able to remember, though I cannot, the burning of the Old Houses of Parliament on the night of Thursday, the 16th of October, 1834. An order had been given by Mr. Milne, a Commissioner of the Office of Works, to destroy certain tallies in the Tally Office of the Exchequer, and through some misapprehension of orders these tallies were burnt in the stores of the House of Lords, the flames of which would appear to have been defective and to have thus caused the fire to spread to the whole edifice, which very soon became a prey to the destructive element, so that at one time even Westminster Hall was threatened.

Immediately after the fire an official enquiry was prosecuted before the Privy Council as to the causes of the disaster about which hung considerable mystery, in consequence of some suspicions that it had been the work of an incendiary; but after a patient investigation their Lordships reported that the fire was purely accidental, and had been caused by the burning of the tallies above-mentioned. Of course the re-construction of the building immediately engaged the attention of the Government, and after Committees of both Houses had reported on the accommodation required, an open competition was advertised in July, 1835. The conditions of competition were in many respects similar to those recently issued for the Government Offices, with one remarkable exception, namely, that they prescribed the style of architecture to be employed, which was to be "Gothic, or Elizabethan." The conditions also provided that the King should be requested to appoint Royal Commissioners to report on the plans of the competitors, who were to send in their designs by the 1st of November of the same year. In compliance with this invitation ninety-seven designs containing from one thousand to twelve hundred drawings were received, and while these were in course of preparation, a Royal Commission was issued to the following gentlemen, all of whom it may be remarked were amateurs, appointing them judges of the competition;—Mr. Hansbury Tracy, Sir Edward Cust, Mr. Liddell, and Mr. Vivian, who reported on the 29th of February, 1836, in favour of designs 64, 14, 13, and 42, giving a decided preference to No. 64, which proved to be the work of Mr. Barry. After various enquiries bearing upon the nature and cost of the selected design, my father was instructed to prepare working drawings and estimates, which he undertook to do—while as regards his remuneration he consented (with a confidence not altogether justified by subsequent events) to leave it entirely in the hands of the Government. Accordingly on the 7th of April, 1837, the Office of Woods reported on the architect's estimate, which had been placed by him in the hands of Mr. Henry Arthur Hunt, who then possessed his entire confidence and advised him in all matters connected with the cost of the projected work. Messrs. Seward and Chawner, on the part of the Office of Works, having carefully examined the architect's estimate, reported their opinion that the design could be carried out for the sum of £707,104. which sum however they stated would not cover many extraneous works connected with the building. This estimate has been so often alluded to, and, as I think, so unfairly contrasted with the real cost of the New Palace, that I shall endeavour, before I conclude, to give some explanations concerning it, calculated to place matters in their true light before you. After this report from Messrs. Seward and Chawner, the works were ordered to be proceeded with, and the first vote of public money on account of the New Palace at Westminster was taken 3rd July, 1837. The first portion of the works was necessarily the construction of the river wall; and this was proceeded with under the joint superintendence of the architect and Mr. James Walker, the well-known Civil Engineer, who divided equally between them the customary remuneration of five per cent. for their services. A coffer dam was constructed in the river, and the foundations of the wall laid upon concrete varying from 1 foot to 12 feet in thickness. In constructing the foundations

great difficulties were encountered, as the soil proved in many cases little better than quicksand, rendering it necessary in consequence to incur much extra expense. The coffer dam answered its purpose completely, and the foundations generally have proved quite successful. When the time came for the removal of the coffer dam, my father resolved, in consequence of his experience of the treacherous nature of the site, not to draw the piles as had been originally intended, but to cut them off level with the dredged bed of the river; this was accordingly done, and the lower part of the dam remains in the ground and acts as a fender, or advanced guard, to the building against the scour of the river. The face of the terrace wall towards the river was faced with granite in large stones, and the walls being, as far as possible, brought up to the level of the terrace, the first stone was laid without any ceremony by my mother on the 27th of April, 1840. While the foundations were proceeding, an enquiry was ordered to be made to ascertain the best and most durable stone to employ upon the super-structure. The Commissioners were Sir Henry (then Mr.) de la Beche, Mr. William Smith, Mr. C. H. Smith, and the architect; who, after a careful enquiry into the matters committed to them, presented a report on the 16th March, 1839, which is I doubt not well known to most present. The result of this report was the selection of the Magnesian limestone from Bolsover Moor and its neighbourhood as the best for the purpose; and though the stone has not perfectly withstood the injurious effects of a London atmosphere, it is doubtful whether any other selection would have proved more fortunate. From April, 1840, the works proceeded with great dispatch under the energetic management of Messrs. Grissell and Peto, who had obtained the contract after a limited competition among the first London firms; and it is only fair to those gentlemen to say, that from the commencement to the close of their connection with the building, their work and their arrangements for conducting the same were such as deserve the highest praise. In January, 1840, Dr. Reid was appointed to take charge of the warming and ventilating arrangements of the edifice with authority derived direct from the Board of Works; thus conferring on him a position altogether independent of the architect. Dr. Reid's scientific attainments are well known, and he certainly succeeded in warming and ventilating the temporary lath and plaster House of Commons; but while wishing to speak of him with all possible respect, I cannot help thinking that to give any man a control, independent of the architect, over so large and complicated a building was an administrative blunder of the highest order. Dr. Reid never professed to have any knowledge of construction or of the practical means of carrying out his plans, and this, as may be supposed, complicated matters considerably. Whether it was in any way wise to attempt to adapt one unvarying system to a huge building like that before us, with its various apartments devoted to so many different uses, occupied some by day and some by night, some in a crowded state, while others are empty, and comprising public halls, offices, debating chambers and private residences, I will not now stop to enquire; suffice it to say, that Dr. Reid's plans soon lost the confidence of my father, who considered them detrimental to the stability, safety and effect of the building, and that they consequently became the subjects of repeated controversies until the cessation of Dr. Reid's connection with the New Palace. Large flues and air chambers were constructed at a great expense, most of which are now comparatively useless, and delays and differences were but the necessary consequences of the error at starting. In the session of 1844, a Committee of the House of Lords which was appointed to enquire into the progress made with the works, in consequence of a natural desire on the part of their Lordships to enter their new House, and a still more natural inclination to blame an architect for anything inconvenient, commenced its labours, and reported that several alterations had been introduced into the design by the architect without any authority from the Government—an accusation he explicitly denied by stating that he had received authority express or implied for all he had done.

The alterations alluded to were a re-arrangement of a portion of the plan between the Victoria Tower and the House of Lords. The modifications were these.

By the original plans the royal carriage was to pass through the Victoria Tower, and set down his Majesty at an inner hall, from which a large flight of steps would have conducted him to his robing room adjacent to the House of Lords, with which it communicated. This was on careful consideration thought undesirable, for the following reasons:—1. The great size of the tower would almost necessarily degrade the appearance of the inner hall, and its important character seemed to claim for itself to be the entrance of the Sovereign. 2. The staircase, though possibly handsome in itself, would have occupied too much space, considering its only occasional use, and with the inner hall would have cut up the principal floor, and rendered communication difficult: the robing room was also somewhat contracted in dimensions, and there was nothing like the present Royal Gallery to serve as a waiting room for the peers, for the admission of strangers to view the ceremony of opening and proroguing Parliament, and other public purposes. Great objections were made by some members of the Lords' Committee to these modifications, and many inconveniences foretold, both to her Majesty and their Lordships, but I am not aware that practice has justified these predictions, or reversed the opinion of the Committee of the House of Commons, which sat soon afterwards, and resolved that "no blame" was to be attached to Mr. Barry for the course he had taken, and that they had every reason to "believe that all the alterations, hitherto made, had conduced to the convenience and general effect" of the building. It was at this time that many complaints began to be made in Parliament about the so-called delay in completing the building, and the anxieties consequent on the various committees and other enquiries, in addition to the unavoidable responsibilities of the architect, caused him a serious illness, and thus made a reality of that delay, which, up to this time, had been imaginary, as far as he was concerned. Indeed had it not been for the hearty and generous support of Lord Lincoln (now Duke of Newcastle) who was then first Commissioner of Woods, I do not think the works could have been carried to a completion by my father. His Lordship took special pains to make himself personally acquainted with the nature and bearing of the various complaints, and having satisfied himself that they were not based on justice, threw the whole of his official weight into the scale, and gave the architect no half-hearted or stinted support in carrying out his views, until the close of his official connection with him. Having now traced the history of the building up to 1844, at which date the plan had finally assumed the shape which has been since executed; I propose to give some description of the edifice as now existing.

It will be remembered that the competitors were directed to design either in the Gothic or Elizabethan style; the former was considered desirable by my father as being "homogeneous, well defined, and more or less in harmony with the existing ancient buildings on the site and in the neighbourhood," while the latter would, he thought, be unworthy of the character of a great national edifice, and inharmonious with the existing buildings. Westminster Hall is made a part of the plan, to form a great public entrance to the entire building, so that it may now be viewed as a part of a great whole, instead of being as hitherto an apparently isolated room, used as a waiting Hall by counsel and other persons in attendance on the Courts of Law. The window at the South end of the Hall was enlarged and is now re-fitted in St. Stephen's Porch, which forms the chief public vestibule of the New Palace. The beautiful crypt of St. Stephen's Chapel and the cloisters adjoining Westminster Hall have been saved from destruction, and form part of the Members' private entrance to the House of Commons. In restoring these, the fan groinings were found to be generally in a sound state, but all the rest of the work was in a deplorable condition. The cloisters have been carefully reinstated, and the windows glazed. Two great buttresses which formerly disfigured the quadrangle have been

removed, and the roof of Westminster Hall has been repaired and strengthened with iron shoes and tie-bolts. Members going to the House have a choice of two entrances, one through Westminster Hall, and the other through the Star Chamber Court. This arrangement was considered desirable on various grounds, and circumstances of public excitement may easily be imagined under which a double entrance might be found extremely convenient. The arcaded passage at the West side of the Star Chamber Court serves the purpose of a porch, and Members then proceed to their private staircases, passing by the cloisters on their way, where they deposit their coats and umbrellas. They then proceed up a groined stone staircase to the upper floor, upon which the House of Commons is situated. A portion of the upper part of the cloisters is occupied by the British Paper Office, and another by a writing room for Members. St. Stephen's crypt is not yet out of the workmen's hands, but is in course of restoration. The groining here is in a very bad state, having been much injured by the fire. The carved capitals and bosses were also very dilapidated, and great difficulty has been experienced in collecting authority for their restoration, but by having squeezes taken of the parts in good repair, which will guide the workmen in their restoration, I believe that object has been now obtained. The crypt was used by the Speaker as his dining room before the conflagration, but is intended when restored to serve as the Private Chapel of the New Palace. It was considered very desirable that the various entrances and departments should be as distinct from one another as convenience of occasional access might dictate, and the Central Hall may be considered the key to the plan. A stranger passes to it through Westminster Hall and St. Stephen's Hall, and finds himself in an octagonal chamber with four archways leading from it, the other four sides being occupied by messengers, and the Electric Telegraph offices. On his right is the House of Lords, with its offices, libraries, and refreshment rooms surrounding it as a nut-shell does its kernel; on the left is the House of Commons, with similar appendages, while straight before him lie the committee rooms and offices connected with the public business of Parliament. St. Stephen's Hall is over the crypt, and occupies the position of the former chapel. It is groined in stone, and the bosses at the intersections of the groin ribs are sculptured representations of the life of St. Stephen, by Mr. Thomas.

The Houses of Lords and Commons are placed in the midst of surrounding buildings, from considerations of convenience of access to and from their offices, &c., freedom from noise or interruption, and general safety. The committee rooms, which are used by day, are placed in the river front, as being the most cheerful and appropriate place for them. The official residences of the Speaker and other officials of the House of Commons are at the North end of the building; while the South wing accommodates the Lord Great Chamberlain, the Black Rod, and other officers of the House of Lords. The Royal entrance is by the Victoria Tower, from which a flight of steps leads to the Royal robing room, an apartment 55 by 37, now in course of being painted in fresco by Mr. Dyce. Her Majesty occasionally grants audiences in this chamber, and having robed, then proceeds along the Royal Gallery (where strangers are admitted to witness the procession) into the House of Peers. The Royal carriage passes in the meantime under the robing room into the Royal court, where it turns round and returns to the tower in readiness to receive her Majesty at the close of the ceremony. The House of Peers is 90 by 45 and 45 ft. high; my hearers must be so familiar with its general aspect, from prints or personal inspection, that I will merely state that it is fitted up with elaborate oak framing, glazed with stained glass representing the various kings and queens of England, and highly decorated with gold and colors. Portions of the end walls have been painted in fresco by artists selected by the Fine Arts Commission, and niches between the windows display statues in bronze, by some of our first sculptors, of the Barons who signed Magna Charta. The House of Commons is a much plainer apartment, though not differing greatly in actual dimensions from the House of Peers.

After a few days' trial, and before the Members had had time to get accustomed to the new chamber, judging moreover from morning sittings, when it is rare that any debate commands the attention of the House, it was determined to lower the ceiling for the sake of improving the acoustic qualities of the room. This was accordingly done, and has certainly not been an improvement as to architectural appearance, though it is said to have answered the purpose proposed. The ceiling is of oak, divided into a flat centre and two sloping sides; the panels in the centre compartment are perforated, and the House is lighted at night by lights placed over them under the control of Mr. Goldsworthy Gurney, who has succeeded Dr. Reid in his office of warmer and ventilator. This mode of lighting is, I believe, considered pleasant by Members, and has the advantage of being external to the room, and contributing to its ventilation; but the glare of unscen light and the deep shadows thrown in all directions, render it very destructive of architectural effect. The Refreshment rooms are supplied with lifts and other modern appliances, and are placed over their kitchen and offices. The Libraries are in the River front; and in the Ground floor a Smoking room is fitted up with every convenience for those hon. Members who wish to relieve their senatorial labors by a cigar. This addition, it may be remarked, is a modern innovation, and was not thought a necessary adjunct when the plans of the building were first arranged. With so many offices and apartments where members may place themselves, it may be imagined that it is a matter of some importance to give them early notice when their presence is required at divisions—this is effected by electricity. Bells are placed in upwards of thirty places, and are connected with a galvanic battery, so that the principal doorkeeper is enabled to make contact and ring all the bells at once, by pressing his hand on a button attached to the arm of his chair. Any stranger who happens to be in the corridors when the bells are ringing, will soon be conversant with the fact of a division being imminent, by the rush of Members in all directions towards the House, which places him in extreme danger of practically testing the hardness of the floor.

Having now given a description of the general arrangement of the plan, I propose briefly to touch upon the external features of the design. Few buildings have been more unfortunately placed than the New Palace at Westminster. A site full of quicksands and below low-water is seldom an agreeable incident in an architect's practice. Moreover, a large majority of the public first see the Palace from Westminster Bridge, which is decidedly the least favorable point from which it is to be seen. When the new bridge is completed, at the lower level, and with the greater width now determined on, a great improvement to the appearance of the New Palace from this quarter may be expected; though it is to be regretted that the new bridge, following the line of the old one, will not be at right angles with the building. But if the present view from the bridge be unsatisfactory, that towards the Abbey is far more so. Here we have the incongruous and unmeaning façade of the Law Courts, the mean houses of the South side of Bridge Street, and the unfinished face of the Clock Tower. It is to be wished that these disadvantages could be removed, and though there may be many opinions as to the best way of treating New Palace Yard, there will I imagine be few against endeavouring to give to the Palace on this side a more perfect and consistent appearance. My father has always advised the enclosure of New Palace Yard, and recommended the removal of the Law Courts from Westminster, not only for reasons connected with the convenience of public business, but also from the difficulty of providing the accommodation required on the very limited site at Westminster.

In designing the new Palace, it was resolved to avoid as far as possible any breaks upon the plan not absolutely dictated by convenience or the nature of the site, such breaks being considered to tend towards reducing the apparent size of the building when seen in perspective. The River front was accordingly carried out without any very considerable breaks in the plan, and reliance was placed

on breaking up the sky-line to avoid monotony ; thus the centre portion is raised a story above the rest, and towers with high roofs play a conspicuous part in the composition, while the main towers of the building rise behind and form a background to the numerous pinnacles and turrets, as seen from the river. The carving between the stories of the river front was intended as a record in stone of English History. There are thirty-five bays, exclusive of the two oriel bays ; each of these thirty-five bays contains the arms of an English sovereign, beginning with William I. and ending with William IV. The oriel bays bear the present Royal Arms of England, with the motto, Victoria Regina felicitat regnans. All the stone carving here, as well as throughout the entire structure, has been executed by Mr. Thomas, to whom this department was specially entrusted by my father immediately after his appointment. Mr. Thomas has carried out my father's views entirely to his satisfaction, and in such a way as to make it impertinent in me to say one word of praise. Mr. Thomas' name and works are now familiar to every architect, and those who have the privilege of his private acquaintance will testify to the ability, skill and indomitable industry, which have won for him the position he now occupies. The wood carving in the interior was not entrusted to Mr. Thomas, but was placed by my father under the superintendence of a gentleman whose name ought never to be forgotten as long as admirers of Gothic Architecture exist in England—need I say that I allude to the late lamented Welby Pugin ? Convinced that in all matters of Gothic detail Mr. Pugin was *facile princeps*, my father sought his aid, first, in forming a collection of plaster casts of famous examples both at home and abroad, and then in superintending the practical execution of this work, by occupying a position precisely analogous to that filled by Mr. Thomas with respect to the stone carving. Mr. Pugin, with the spirit which always actuated him, readily assented to this proposal, and continued till nearly the time of his death to aid my father in carrying out his designs ; in this manner his services were invaluable, and a number of carvers were trained under his auspices, more or less imbued with the spirit which animated himself. Mr. Pugin's department comprised the wood carving, the ornamental metal work, stained glass and tiles, at all of which he worked most indefatigably to carry out my father's views, which were naturally in many cases not altogether in unison with his own, but to which he at all times deferred. When I think of the good humoured discussions, and the frank and hearty criticism in which he used to take part, it gives a fresh pang to the thought that that voice will be heard no more, and that a luminary so bright should have suffered so mournful an eclipse. I have often heard Pugin called a bigot and enthusiast, and possibly some of his earlier writings may give a color to the imputation ; I suppose, however, that no reformer of time-honored abuses who is thoroughly in earnest can avoid such accusations, and those who knew Pugin most intimately will hesitate to endorse such a charge, and will know that he was (especially in his latter days) far more candid than many who now echo his views, without acknowledging the source whence they are derived. It ought never to be forgotten that Pugin upheld sound principles of design and construction at a time when his opinions were far from fashionable, and that he consequently stood almost alone ; and I think we of the present generation of Architects, who have benefited so largely by his labors, ought jealously to guard his fame, and not allow any one, however popular, to retail his opinions without giving due honor to their author. I must apologize however for this digression and proceed with my task of description. The residences of the various officials whom I have mentioned above are almost all now occupied, and have been fitted up with every regard to modern ideas of comfort and refinement. Though every portion of the fittings and furniture is of a Gothic character, it has been my father's aim to shew, as far as possible, that the notion of a Gothic house being necessarily inconvenient, is a fallacy founded upon an imperfect appreciation of the extent to which

the resources of the style may be developed, and that there are no modern appliances from which the dweller in a Gothic residence need be debarred.

The most important portions of the New Palace, as regards its external appearance, are undoubtedly the main Towers, and a short description of these may not be undesirable. The Central Tower is now completely finished, and I will therefore speak of it first. The foundations were laid upon 7 ft. 6 in. of concrete, and great care was taken in building them, in consequence of the large apertures required by Dr. Reid, which pierce the basement story in all directions; the principal floor is carried upon a brick vault, springing from the walls to a circular cast iron curb in the centre, supported by columns, and the ceiling over the octagon or Central Hall is a stone groining 70 ft. span, without any central shaft; this groining was intended by my father to have been considerably higher than it now is, but the demands of Dr. Reid for extensive air spaces over it compelled the adoption of the present lower design. A strong wrought iron tie bar is inserted in the wall all round the tower, at the springing line of the groining. The upper part is carried upon a brick cone, starting from the top of the walls of the octagon. This cone carries the lower lantern, which in its turn supports another and a smaller cone, upon which the upper lantern and the spire are constructed. These cones were built without centering, and there were many peculiarities in the process of constructing the tower, but as you have already heard a description of these matters, I forbear to touch upon them now. The Central Tower was intended by Dr. Reid to be the central point of discharge of vitiated air from the whole building, but I believe Mr. Gurney makes little or no use of it for that purpose at present. The Victoria Tower is situated at the South Western extremity of the building, and its general features are no doubt familiar to you. The carefully executed model on the table by Mr. Mabey, will give a better idea of its appearance than any description that I can write. Great precautions were necessary with the foundations, as the site was extremely bad and full of quick sands. A double close row of piles was driven completely surrounding the site, the earth within this species of coffer dam was then excavated, and concrete thrown in to a depth of 10 ft. 7 in. Two courses of 6 in. landings were then placed on the concrete, and upon them the walls were carried up, without accident of any kind. The corner octagonal turrets are built hollow, being intended to be used by Dr. Reid for the passage of air. One of these corners contains an open iron staircase which gives access to the top; the upper portion of the turrets finishes with a light open pinnacle, in which a winding staircase will be inserted. The various floors of the tower are fitted up with iron beams and columns, forming so many fire proof receptacles for records and papers of value, and the place have been so arranged as to admit of a lift passing up the well-hole of a staircase in the middle of the tower, communicating with the various floors. The roof is now in course of construction, and most of the iron-work for it is ready for fixing. My father has determined to make it of the general form shewn in the model, but there are some questions connected with the flag post and other details at present undecided. There is however little reason to doubt that this year 1858 will see the last plate fixed on the roof. In describing the towers of the New Palace, the Clock Tower must not be forgotten; it stands at the North end of the building, and from its propinquity to the bridge is perhaps made more the subject of comment than any other portion of the edifice. My father's view in designing this tower was to make the clock the predominant feature; all else was to be pedestal or roof. The windows are few and narrow, and hardly prevent the tower from appearing actually solid, while the roof with its decorative metal work and gilding, forms one of the most conspicuous features of the building, when seen from a distance. The model before you from the same skilful hand as the others, sufficiently explains the nature of the design. The interior of the tower is taken up by the shaft for the clock weights, a staircase from bottom to top, a large vitiated

air-shaft required by Dr. Reid, and a few prison-rooms, supposed to be for the benefit of refractory Members of Parliament. My hearers have heard a great deal about the clock which is yet to come, and also about the unfortunate Big Ben, over whose tragic fate it only remains to drop a tear. Every arrangement in the tower is ready both for clock and bells, and has been so for a considerable time, but it is to be hoped that the new bell will not be in so great a hurry as the last, to ring his own dirge. Both clock and bell will be hoisted up the central shaft in the tower in the same manner as the whole of the building materials have been raised, for it may be remarked, in passing, that the Clock Tower as well as the Victoria Tower have being built entirely without external scaffolding,—hence the silly story about hoisting the clock and bells, which was started some time since. The clock faces are of cast-iron perforated, and the apertures in them are filled in with white glass, opaque by day, but admitting of illumination by night, without rendering visible the light placed behind it.

As the works of the New Palace proceeded, it was thought that the erection of so large and costly a National Building afforded a suitable opportunity for encouraging the artistic energies of the country, with reference to the embellishment of the interior by the sister arts of Painting and Sculpture. A Royal Commission was therefore issued to certain distinguished noblemen and gentlemen, presided over by His Royal Highness the Prince Consort. The architect was called on to present a report to the commission (of which he is not a member) expressing his views generally on the subject. This was accordingly done, and I may perhaps be permitted to quote some passages from his report:—

“With reference to the interior of the new Houses of Parliament generally, I would suggest “that the walls of the several halls, galleries, and corridors of approach, as well as the various “public apartments throughout the building, should be decorated with paintings having reference to “events in the history of the country, and that those paintings should be placed in compartments “formed by such a suitable arrangement of the architectural design of the interior, as will best “promote their effective union with the arts of sculpture and architecture; with this view, I should “consider it to be of the utmost importance that the paintings should be wholly free from gloss on the “surface, so that they may be perfectly seen, and fully understood from all points of view, that all other “portions of the plain surfaces of the walls should be covered with suitable architectonic decoration, “or diapered enrichment in colour, occasionally heightened with gold and blended with armorial “bearings, badges, cognizances and other heraldic insignia emblazoned in their proper colours. That “such of the halls as are groined should have their vaults decorated in a similar manner, with the “addition occasionally of subjects, or works of art, so interwoven with the diapered ground as not “to disturb the harmony, or the effect of the architectonic decorations generally, or interfere with “the elementary features of the architectural composition. That such of the ceilings as are flat should “be formed into compartments by moulded ribs, enriched with carved heraldic and Tudor decorations. “That these ceilings should be relieved by positive colour and gilding, and occasionally by gold “grounds with diaper enrichments, legends, and heraldic devices in colour. That the screens, pillars, “corbels, niches, dressings of the windows, and other architectural decorations should be painted to “harmonize with the paintings and diapered decorations of the walls generally, and be occasionally “relieved with positive colour and gilding. That the door-jambs and fire-places should be constructed “of British marbles of suitable quality and colour, highly polished and occasionally relieved by colour “and gilding in their mouldings and sculptured enrichments. That the floors of the several halls, “galleries and corridors should be formed of encaustic tiles, bearing heraldic decorations and other “enrichments in colour, laid in margins and compartments, in combination with polished British “marbles, and that the same description of marbles should also be employed for the steps of the several “staircases. That the walls to the height of from eight to ten feet should be lined with oak framing

"containing shields with armorial bearings emblazoned in their proper colours, and that an oak seat should in all cases be placed against such framing. That the windows of the several halls, galleries and corridors should be glazed doubly, for the purpose of tempering the light and preventing the direct rays of the sun from interfering with the effect of the internal decorations generally; for this purpose the outer glazing is proposed to be of ground glass in single plates, and the inner glazing of an ornamental design in metal filled with stained glass, bearing arms and other heraldic insignia in their proper colours, but so arranged that the ground, which I should recommend to be of a warm yellowish tint covered with a running foliage or diaper, and occasionally relieved by legends in black letter, should predominate, in order that so much light only may be excluded as may be thought desirable to do away with either a garish or cold effect upon the paintings and decorations generally. Practically, I consider that the double glazing will be of essential service in carrying out the system of warming and ventilating proposed to be adopted in the building generally, which system renders it unnecessary that the windows in those portions of the building above referred to should be made to open, so that all prejudicial effects upon the paintings and other decorations which might be caused by the dampness and impurity of the atmosphere, and much practical inconvenience, and probably unsightliness in the means that would be necessary to adopt for opening and shutting casements, would be avoided. That in order to promote the art of sculpture and its effective union with painting and architecture, I would propose that in the halls, galleries and corridors statues might be employed for the purpose of dividing the paintings on the walls. By this arrangement a rich effect of perspective, and a due subordination of the several arts to each other would be obtained. The statues suggested should be, in my opinion, of marble of the colour of polished alabaster, and be raised upon lofty and suitable pedestals placed close to the walls in niches surmounted by enriched canopies; but the niches should be shallow, so that the statues may be as well seen laterally as in front. The architectural decorations of these niches might be painted of such colours as would give the best effect to the adjoining paintings, being relieved in parts by positive colours and gilding, and the backs of them might be painted in dark colours, such as chocolate, crimson or blue, or they might be of gold for the purpose of giving effect to the statues. Having thus described the views I entertain as to the character of the decorations of the interior generally, I now proceed to notice in detail the special decorations and arrangements which I would propose for the several halls, galleries and principal apartments.

"I would propose that Westminster Hall, which is 230 feet long, 68 feet wide, and 90 feet high, should be made the depository, as in former times, for all trophies obtained in wars with foreign nations. These trophies might be so arranged above the paintings on the walls as to have a very striking and interesting effect. I would further suggest that pedestals, twenty in number, answering to the position of the principal ribs of the roof, should be placed so as to form a central avenue, 30 feet in width, from the North entrance door to St. Stephen's porch, for statues of the most celebrated British statesmen, whose public services have been commemorated by monuments erected at the public expense, as well as for present and future statesmen whose services may be considered by Parliament to merit a similar tribute to their memories. The statues which have been already proposed to be placed against the walls between the pictures, I would suggest should be those of Naval and Military commanders. The subjects of the paintings on the walls, twenty-eight in number, 16 feet in length, and 10 feet in height, might relate to the most splendid warlike achievements in English history, both by sea and land, which, as well as the statues that are proposed to divide them, might be arranged chronologically. To give due effect to these suggested decorations, it is proposed that the light should be considerably increased by an enlargement of the dormer

" windows in the roof, by which also that extraordinary and beautiful piece of decorative carpentry of the fourteenth century may be seen to much greater advantage than has ever yet been the case. " This noble hall, certainly the most splendid of its style in the world, thus decorated by the union of painting and sculpture and architecture, and aided by the arts of decoration as suggested, it is " presumed would present a most striking appearance, and be an object of great national interest." Here follow some detailed recommendations as to other parts, with which I shall not trouble you, after which the report proceeds:—" I have now described in general terms the whole of those portions " of the building that might, I think, with propriety and effect be adorned with works of art and the " arts of decoration, hut in making the several suggestions which have occurred to me, I should wish " it to be understood that I have merely stated my own views on the subject as far as I have hitherto " been able to consider it in its general bearings, and with a view to shew how the objects for which " the commission has been established may, if desired, be carried out in the decorations of the new " building to their greatest extent. I should not, however, wish to be strictly confined in all cases to " the adoption even of my own suggestions, as upon a more mature consideration of the subject in " detail hereafter, when the shell of the building is completed, I may be induced to vary and modify " some of the views which I entertain at present, and which, I fear, I have but imperfectly communi- " cated in this paper."

The two drawings of St. Stephen's Hall and the Royal Gallery, by Mr. Nash, exemplify my father's views as above quoted, but since the time of their appointment, the Royal Commissioners have taken entire charge of the various fine art decorations which have been introduced into the building, and have held exhibitions in Westminster Hall of cartoons and sculpture submitted to them in competition. Frescoes have been painted in the House of Lords by Messrs. Dyce, Cope, Macise and Horsley. In the upper waiting hall, River front, by Messrs. Cope, Watts, Herbert, Horsley, Tenniel and Armitage. The Queen's robing room is now in the hands of Mr. Dyce, and the Peer's robing room is committed to Mr. Herbert. Mr. Ward is also engaged on a series of pictures for the corridors leading from the central hall, some of which have already been exhibited. Bronze statues have been placed in the niches of the House of Lords by Messrs. J. Thomas, J. C. Thomas, M'Dowell, Woodington, Timbrell, Westmacott, Thornycroft, Thrupp and Richie. Large white marble statues have also been erected on the pedestals in St. Stephen's Hall, by Messrs. Foley, Beil, Marshall, M'Dowell, Bailey and Carew. In speaking of these last named statues, while admitting most of them to be extremely beautiful works of art, I cannot hut regret that they should have been executed on so large a scale as to be detrimental to the architectural effect of the hall. The same remark would apply to the fine group by Gibson in the Prince's chamber. In this case the figures are more than 9 feet high, while the room is only 45 by 25. In the Prince's chamber Mr. Theed has designed some bas-reliefs of historical subjects in the panels, which have been electrotyped from his designs, and add greatly to the appearance of the room. Paintings have also been commenced in the wall panels of this chamber, which display satisfactorily the effects of the gold hack-grounds which my father has always recommended as the most suitable in such cases. When I add that to Mr. Macise is entrusted the embellishment of the royal gallery, I have, I believe, completed the list of works carried out by the Fine Arts Commission. With the exception of the works above mentioned, the sculpture of the building has been completed, as I before said, under my father's guidance by Mr. Thomas, as regards the stone carving, and by carvers under the direction of Mr. Pugin in all matters relating to the wood finishings of the building. The sketches of statues before you by Mr. Thomas will give some notion of the style of sculpture adopted. After many delays with reference to the ventilation of the House of Peers, which was ultimately removed from Dr. Reid's control, the Chamber was completed, and was opened

on the 15th of April, 1847, without any public ceremony, and from that day to the present has been in constant use. The Poets' libraries and refreshment rooms were opened at the same time, and on the 3rd of February, 1852, the whole of the public entrances, with the House of Commons, Central Hall, and St. Stephen's Hall, and adjoining offices were delivered up by the architect. Since that time most of the remaining portions of the edifice have been completed, and at this moment very little remains to be done. The Speaker's house is all but finished, and will be occupied after Easter. The residences in the South wing will be completed in a few months, and before long the main towers, the Royal gallery, and the Royal staircase will be ready for occupation, so that by the close of the year the present works at the New Palace will be brought to a close. Much has been said about the time the edifice has taken to construct, but I think, in addressing an audience like the present, I have no need to say much on that head. It may suit those who imagine an architect can be urged onward to any extent by external irritation, to complain of the rate of progress at the New Palace, but when the difficulties of all kinds which have beset the work are duly considered, and it is borne in mind that the public business of the country has never been interrupted for an hour, but has always possessed temporary accommodation on the site, which has only been handed over piecemeal to the builders, architects at any rate will not think the time that has elapsed between the laying the first stone in 1840, and the completion of the building in 1858, has not something to show in the work that has been done.

I may now proceed to say a few words on the cost of the Palace, which, though very large, has been much exaggerated. The total cost of the structure up to the present time, as far as the architect is concerned, has been £1,768,979. 8s. 1d.; and it is not surprising that those who look at these figures, and then contrast them with the original estimate of £707,104. should demand some explanation of so enormous an excess. But the building to which the original estimate applied, and that which now exists, are two different things, though the public who call them both New Houses of Parliament, cannot be expected to understand the difference. The following are some of the many modifications of the design which have been sanctioned by the Government since the original estimate was made:—1. The river embankment and coffer dam were not included, and it was found necessary to go down much deeper for the foundations on account of the treacherous nature of the soil than had been at first intended. 2. A much harder stone was selected than that on which the estimate was based, and I may state that the labour on Anston stone is considered by competent authorities greatly to exceed that on Portland. 3. The building was ordered to be made fire-proof by the substitution of iron girders and brick arches for ordinary floors, and iron roofs instead of slated coverings were ordered to be formed. 4. Arrangements for warming and ventilating were expressly excluded, and those who will take the trouble to look at the general sections of the building will see by the space they occupy, compared with the habitable portions, that these can have been no inconsiderable items of expense; indeed, portions of the building were carried up for the purpose of providing continuous air and smoke flues in the cross roofs connecting those in the main building. The Central Tower is also an addition, not having formed part of the original estimate, nor having received the sanction of Parliament until the rest of the works were in an advanced state of progress. Many extra suites of rooms and offices have been added; amongst others, complete residences for the Clerk of the House of Commons, the Clerk of the Crown, and the gentlemen in charge of the ventilation of the building, as well as many other smaller works too numerous to be mentioned here. The works consequent on the orders of the Fine Arts Commission and the restoration of St. Stephen's Crypt, also formed no part of the original estimate, and a more elaborate mode of internal finishing was rendered necessary by the determination to make the building a means of encouraging the Fine Arts of Painting and Sculpture. When these circumstances are borne in mind, and the

upward tendency of prices for labour and materials during the last ten years is also remembered, it will, I think, be seen that a mere comparison of the original estimate with the actual cost of the edifice does not present a fair aspect of the case; and many present will readily understand the numerous unavoidable expenses which gather round a building of such size and peculiarities as the New Palace at Westminster.

The present iron roofs were adopted in consequence of the requirements of the ventilating scheme which provided smoke flues stretching along the roofs in all directions, and which being necessarily heated to a considerable temperature required a fire-proof covering not likely to be injured by heat. Galvanizing was adopted as a means of protection after considerable inquiry, and after it appeared it had been used extensively in the public establishments of France. Experience has shown that, however well it may answer elsewhere, galvanized iron will not long resist the injurious effects of a London climate and atmosphere; and the means of protecting the iron roofs at the New Palace have occupied much of my father's attention. At last, after a great many trials of different paints and other compositions, one by Mr. Szerelmey, a Hungarian gentleman, has appeared to him to promise great success. Mr. Szerelmey has already applied his process to the roof of the Clock Tower and some other portions of the building, and if it should succeed, as it seems likely to do, the whole of the roofs will probably be treated in the same manner. Mr. Szerelmey also applies his composition to stone work, and has furnished me with the specimens of iron and stone, both of which are coated with his composition, which he informs me will not cost much more than a coat of ordinary paint, and will not discolour the stone.

No orders are yet given with reference to the remaining portions of the design adjoining Westminster Hall and New Palace Yard, and, in fact, the question of the removal or non-removal of the Law Courts from Westminster must be determined, before anything can be done with a large portion of these buildings, my father's designs for which are shown in a Parliamentary paper of the Session 1855. They display a great entrance gateway, with flanking turrets, at the corner of New Palace Yard, which would form the Public entrance to the building, as distinguished from the Royal entrance at the other corner under the Victoria Tower. The construction of the new bridge of twice the width of the present Westminster Bridge, with the increase gained towards the New Palace, will render the destruction of the houses on the south side of Bridge Street a matter of public convenience, and almost of necessity, and the lowering of the roadway can hardly fail to render the view of the building from it more favourable than it can be said to be at present. The Institute has already had the advantage of a very interesting description of the works of the new bridge, which are being carried on under the directions of Mr. Page, C.E., who is pushing them on with great energy. My father's views with respect to it have always been, that (assuming public convenience to require a bridge at Westminster), it should be as wide and low as possible, having regard to the importance of the traffic over it as well as the water traffic beneath. The width he was anxious to obtain was 100 feet, but 84 ft. the width now decided on, is a good instalment, and will greatly exceed that of any other metropolitan bridge. The arches are not to be two or four centred, but in a continuous curve, reminding us of the bridge of Santa Trinità at Florence. The piers however will be far less bulky than in that celebrated example. A portion of the structure will, it is hoped, be opened towards the close of this year, if no unforeseen difficulties should arise. Mr. Page's designs for the construction of the bridge have been subjected to very severe criticism, as may be seen by the minutes of evidence taken by the last Committee of the House of Commons which sat on the subject, but which reported in Mr. Page's favor. The design exhibits so many novelties and ingenious contrivances that the profession cannot fail to watch with interest the engineer's proceedings, and wish him every success in conducting his responsible undertaking to a close. Before I conclude, there is one point to which I may be expected to

allude, namely the professional remuneration of my father as architect of the New Palace, but the whole question has been so recently before you, and the agitation of it at all was so distasteful to him, that I shall only briefly allude to it here, to state on the authority of a Treasury minute, that their lordships considered it "liberal" to force on an unwilling recipient a scale of remuneration less than is enjoyed by those of equal standing, whether engaged on public or private works; and that they thought it "fair" to avail themselves of the power possessed by a Government to refuse any reference of the case to an impartial authority, though they invariably concede such a privilege to tradesmen whose accounts are disputed. The contractors engaged upon the work have been very numerous, and I cannot now name more than those principally concerned, Messrs. Grissell and Peto, and afterwards Mr. Grissell alone conducted the works up to 1852, after which Mr. Jay undertook the contract, which he is now carrying out in a manner thoroughly satisfactory. Messrs. H. and M. D. Grissell have executed a great part of the iron-work with their usual excellence, and Mr. James of Broadwall has carried out the iron roof of the Clock Tower, and some other parts of the iron-work since the beginning of Mr. Jay's contract. When I have said that Messrs. Hardman have supplied the ornamental iron-work and stained glass, Mr. Crace the decorations, carpets, curtains, &c., Messrs. Gillow the furniture, and Mr. Minton the tiles, I have, I believe, described the most important contributors to the work under my father's direction. Mr. Crace has taken great pains with the upholstery, &c. which he has executed to my father's entire satisfaction, but these matters as well as the furniture are now being carried out (designs included) by the Office of Works, and are altogether removed from the control of the architect. I must not forget that the greater part of the hot-water pipes, boilers, and kitchen fittings, have been supplied by Mr. Jeakes, who well understands all such arrangements. Mr. Robert R. Banks was my father's Chief Assistant, and very ably carried out his views during the earlier years of the New Palace, and until he entered upon his present partnership with my eldest brother. The post of principal Clerk of the Works has been filled for many years by Mr. Thomas Quarm, whose skill and energy in conducting the works could not I believe have been surpassed. The elaborate scaffoldings of the towers have been carried out by him partially under the direction of Mr. Meeson, in whose great constructive ability my father has always had the highest confidence, and to whom he entrusted the principal management of such matters; and I think the fact that there has not been a single accident in carrying out the works due to the building operations, indicates no ordinary skill in those who have been responsible for their direction. Those of my hearers who have noticed Mr. Quarm's recent scaffolding at the Clock Tower, will, I am sure, admit that there has been plenty of scope for ingenuity in such arrangements.

I have now very imperfectly completed my task of describing the New Palace at Westminster, and my wish has been not to forestall your judgment upon it, but to place before you some of the materials for forming a correct opinion for yourselves. An architect is generally considered by the public to have every thing his own way, and is visited with a censure of aught that displaces directly proportioned to his supposed omnipotence. The time is not yet come for a full and complete history of the whole subject of the New Palace at Westminster; but when the many difficulties which have environed the work are borne in mind, as well as the numerous masters under whom it has proceeded, it must, I think, be admitted that the architect has some right to expect that the criticism on his production, however severe it may be, should at least partake of a discriminating character. It is not for me to enter here upon questions of taste, which it would be most unbecoming on my part to discuss. The building stands a great fact, and will be calmly judged eventually on its merits and defects by posterity, whose verdict it is worse than useless to attempt to forestall, and who will probably remember that it was nearly, if not quite, the first attempt on a large scale to revive Gothic architecture as applied to civil public purposes—that it was erected in less than twenty years, and by a single architect.

Mr. M. DIGBY WYATT, Hon. Sec., said that, although a junior member only of the profession, he rose, as being to some extent the organ of the Council, who felt that, however desirous and indeed properly impatient the meeting might be to pass a vote of thanks to Mr. Edward Barry for his eloquent and interesting paper, there was another duty which must take precedence even of that. It had been warmly felt by the Council that a resolution should be passed, if the meeting thought fit, expressing in some degree the high sense which it, and the architectural profession generally, entertained with regard to the great work which had been described. He would therefore move "That this meeting desires to convey to Sir Charles Barry, through his son Mr. Edward Barry, whose admirable description of his father's greatest work they had this evening heard, an assurance of their profound admiration of the zeal, energy, taste, knowledge, and capacity displayed by him in the creation of the great national work he has now brought to a proximate conclusion. It desires to offer him their sincere congratulations upon this occasion, and to express the hope that with renewed health and strength he may long survive to receive the honour and respect to which he is so justly entitled, not only from his professional brethren but from the public at large." (*Loud cheers.*) If the proposition had not been so warmly accepted by the meeting, Mr. Wyatt felt he might have urged many pleas in its support, but after the glowing reception it had met with, he did not think a single word more was necessary.

Mr. ASHWITEL, Fellow, felt very great pleasure in seconding the resolution. But one word more should be added to it by him, and that was to express the personal respect which every one who knew Sir Charles Barry must feel for him, and their appreciation of the kindness with which he had always treated every member of the profession. (*Cheers.*)

The CHAIRMAN, Mr. G. G. Scott, V.P., said that he would not put the motion in the ordinary way, but would beg the meeting to pass it by acclamation. (*Carried with loud cheers.*)

Mr. J. G. CRACE, C.V., hoped that, having been employed by Sir C. Barry in a very humble way to assist in carrying out the magnificent monument which his son had so well described, he might be allowed to make a few observations. He had himself received so much kind encouragement from Sir C. Barry at various times, that he could not remain silent on the present occasion. He could testify to the great anxiety which Sir C. Barry had felt on all occasions as to all the details of this magnificent work. He could speak to what was not known to all—to his anxious care, and to his working by the midnight lamp, and in the early morning, to devote the utmost thought and care in raising up a monument which should speak to future times, and he could also speak to the high degree of art and skill which Sir C. Barry had assisted in producing in the various branches of decorative art. By these means Sir C. Barry had raised up a school of artists, which had caused England to obtain a character for art in foreign countries which she would not otherwise have possessed; for, he thought it would be admitted by foreigners that the Gothic style was better understood in this country at the present day than in any other country whatever. But what he felt most was a sense of burning indignation, when he read the mistaken and disparaging remarks which had been made by members of the House of Commons,—in that house which Sir C. Barry had himself provided for them,—without caring for their accuracy or inaccuracy, and that those remarks should have been allowed by others who must have known better to pass, without their springing forth to explain the mistakes that were made. He could not help contrasting those remarks with the words of a truly noble man—a foreign Ambassador—the Count St. Aulaire, who was so much struck on viewing the Houses of Parliament that he exclaimed, "*je me sene humble*," "I feel," he said, "my own humility in the presence of such a monument of science and art as I now see." He (Mr. Crace) hoped he should be excused for having expressed these sentiments, which had hung upon his mind for many a day, and for occupying the

time of the meeting in expressing his respect for the great talent displayed by Sir Charles Barry in this magnificent structure.

Mr. T. H. WYATT, Fellow, moved the thanks of the meeting to Mr. Edward Barry. He called upon them to express their cordial appreciation of the clear, eloquent, and modest paper which that gentleman had read, and to testify their cordial approval of the value and interest of such a practical and sensible communication. Having been for a short time the master, if he might say so, of Mr. Edward Barry, he could bear testimony to his great ability, zeal, and exertions.

Mr. E. C. HAKKOWILL, Fellow, hardly knew whether it was more difficult to speak or to be silent on such an occasion as the present. He would, however, venture to add one word of congratulation to Sir C. Barry, and if any excuse were required for his doing so, he might say that he was himself a competitor with that great architect for the same work, which had been now described; but he rejoiced in his success, and considered it a great privilege to be present to offer his congratulations to Sir C. Barry on its near completion. Another source of congratulation in which all must join, was that his sons had grown up around him, and were ready to carry on his name and fame for at least another generation. (*Cheers.*) He seconded with pleasure the vote of thanks to Mr. E. Barry.

The CHAIRMAN could not put the vote to the meeting silently. It was impossible for any member of the profession, and particularly any one whose attention had happened to be turned to the Gothic style of architecture, to see the New Houses of Parliament brought to their completion without considerable emotion, and without a feeling of joy at the great success which had attended the work; and at the present moment, when the whole profession had been filled with sympathy for the severe illness from which Sir C. Barry was just beginning to recover, their feelings must necessarily be much stronger than at other times. At such a moment they could not but join most heartily in the congratulations expressed in the motion proposed by Mr. Digby Wyatt. The criticisms which had been alluded to by Mr. Crace were of course to be taken for what they were worth—somewhere about nothing. Posterity, as well as the present generation, would decide the question of the merits of this great work. No other building of the present, or of the last three or four centuries, could be compared with this, either in respect to its magnificent towers, its internal finishing, or its adaptation to the multifarious wants it was intended to supply. Moreover, the manner in which the subsidiary arts had been carried out by Mr. Thomas, Mr. Crace, Mr. Minton, Mr. Hardman, &c., was most remarkable, and there certainly was no other building in which such a coarseness of these subsidiary arts had been displayed.

Mr. CRACE, C.V., further observed, that great benefit had been derived by the application, in the Houses of Parliament, of the true principles of decoration in metal work, especially in gas fittings, in the general lighting of the building, in ornamental iron work, carpets, paper-hangings, furniture, and every branch of Mediæval ornament. The theories on which this system of decoration were based first came into definite practice when this great building was in progress; and it was there shewn that the principles were sound and capable of being carried out more ornamentally and beautifully than the false principles previously in vogue. The Houses of Parliament were commenced before these principles were re-discovered or re-introduced, and their application to a building of such great importance carried conviction to the mind, and shewed the value of their introduction. He did not claim for Sir C. Barry the introduction of these principles, but he had acknowledged the truth of them, and carried them out; and every one must acknowledge the great improvement in the manufacture of these branches of art which had ensued from their being put in practice in so prominent a place.

Mr. BURNELL, Associate, having made an enquiry respecting the process of preserving the stone work—

Mr. M. D. WYATT, H. S., proceeded to read some observations by M. Szerelmeý on the attempts made by him to prevent its decay in the building. It appeared, however, that the process had not been patented; that it was therefore a secret, and that M. Szerelmeý should not be pressed too closely upon the subject.

After some discussion, Mr. DIGBY WYATT, in order to recall the meeting, which, in entering into such technical details, had, he conceived, rather deserted the subject of the evening—Sir Charles Barry's great work—ventured to offer a few observations with respect to it.

When any object was placed too near or too far from the eye of the observer, it was always difficult either to test its scale, or determine its real merit. This was strikingly the case with the general estimation in which architectural monuments have been usually held during the life-time of those who have produced them. They were like historical events and political changes, not to be properly appreciated till long after their occurrence, or introduction. The great incidents of youth were rarely correctly judged, even by wise men, till "time had thinned their flowing hair." Hence arose the difficulty of realising the importance of such a great work as the New Palace at Westminster. If they could now summon before them the architects of Cologne, Strasburgh, or any of our great English Cathedrals, or even the sons of those architects, to recount the difficulties and struggles undergone in the working out of those master-pieces of art, surely all must acknowledge that it would be most interesting to every professional man; and now, when they considered the skill and ability displayed in the New Houses of Parliament which had given to every individual feature its useful purpose, and graceful proportion—when they reflected that in all that mighty maze there were a plan and method without feebleness or an awkward bringing together of parts anywhere throughout the structure, they must feel it to be a gratification and a privilege that the architect should be yet living in their own days to see its completion; and that, in his very life-time, his son should be before them to tell them how it was done, and to answer any questions they might wish to ask with regard to any portion of it. With the construction of all great architectural monuments, all the other technical arts of a country commonly made a great stride. It was so in the case of the Parthenon, of Sts. Sofia, of Cologne Cathedral, and all the great works of antiquity, the Middle Ages, and those of the Renaissance. The triumph of all the minor technical arts was involved in that of architecture, and this was the reason why architecture might fairly be looked upon as the father of the other arts—enlisting the others in its train, and counting it one of its greatest privileges to develop them. Power could only be correctly tested or measured by resistance; and it was only by considering the obstinacy, prejudice, selfishness, and and illiberality which Sir C. Barry had had to encounter, that they could measure the energy and the intense ability by which alone he could have carried his great work through; and lived to tell the tale, and reap his due harvest of laurels, if not of lucre.

Mr. T. H. LEWIS, Fellow, wished to know to what extent Sir C. Barry had been able to carry out those views of colouring and internal decoration which he had expressed in the extract read by Mr. E. Barry.

Mr. E. BARRY said that he had already enumerated all the decorations actually executed. The decoration now rested entirely with the Fine Arts Commission.

The CHAIRMAN said that, although it was perhaps considering the subject in too low a light, he should like to mention the question of cost, on which an immense deal had been said. He had been assured by Sir C. Barry that the cost of the Houses of Parliament, with reference to their cubic contents, had been in fact less than that of any other public building in the country. This was the more

remarkable, considering that the stone used was of the hardest description, that there was not a shabby bit in the whole building, inside or out, that the joiner's work was of the most superb character, and that the style of architecture was carried out in its fullest integrity. He had only now to convey the thanks of the meeting to Mr. Barry, and to express the personal regard which they must all feel towards Sir C. Barry—their sympathy for his late illness, and their gratification at its happy termination; together with their hope that his life might be spared to see his glorious work long after its completion.

The meeting then adjourned.

CORNFLOWER



PLUMBAGO
CAPREOLATA



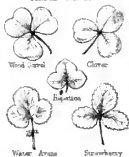
ARCTIA MUNDSTALLERA



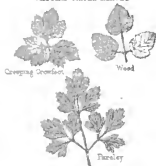
SIMPLE LEAVES



TRIPLE LEAVES



COMPOUND TRIPLE LEAVES



NEW LEAF LEAVES



FINCH LEAVES



FERN



WHITE LILY



Conventionalized

MAPLE, WITH LEAVES



Conventionalized

USUAL CLASSIC LEAF



With proposed manner of simplifying same



WHITE LILY



Looking on the side of Flower



RED OR PINK TULIP



PANSY

WOOD ANEMONE



LILY

Looking down on top of branch

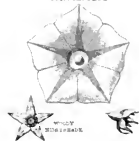
WALL FLOWER



MAPLE



FUCHSIA



CONVOLVULUS

WINDY

SHADE



PRIMROSE



HOLLYHOCK



APPLE BLOSSOM

STRAWBERRY

SHADE



CAMPANULA

STRAWBERRY

SHADE

ON NATURAL AND ARCHITECTURAL FOLIAGE.

By J. K. COLLINS, Associate.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, February 8, 1858.

FROM the time of the Egyptians and other ancient nations down to the present, decoration in architecture has been taken almost invariably from animal or vegetable life. The human form, as the perfection of natural beauty, was dwelt upon with delight, and idealized by the artists and sculptors of old, whose works will, for their transcendent merit, be guarded as treasures of art to the end of time. The inferior animals also had their share of attention until the inanimate stone and marble were made to assume, by the aid of the chisel, a life which will long endure to instruct and delight. In these works man has always been fond of trying to create, instead of merely copying; he has not been content to take nature as he found it, but has made his statues superior to himself, culling all the beauties and omitting what he considered faults. In numberless instances he has created new beings of his fancy, by blending and amalgamating animal and even vegetable forms with the human; birds with animals; animals with fishes,—nothing, in short, has been left untried to elicit new beauty by new inventions. But apart from the higher class of sculpture, should the Architect be fortunate enough to be able to introduce it, there is still a vast field of decoration, the clothing, as it were, of architecture, which has been invariably taken from the vegetable kingdom; and although it is of an inferior class of sculpture to that which embraces animal and human forms, architecture depends greatly upon it for its beauty of expression and loveliness to the eye.

Nature, indeed, teaches us a useful lesson in decoration, for where not prevented by man, she enriches and decorates nearly every portion of the earth with beautiful foliage, such as is best suited to the spot, and characteristic of its position on the globe. So it was until modern times with architecture. The Egyptians copied the papyrus and the lotus which grew in profusion on the banks of the Nile; the Hebrews the pomegranate and the almond, common in their land: thus the robes of the high priest were decorated with pomegranates, and the seven-branched candlestick was expressly modelled from the almond, each branch “with his knops and his flowers.” The Greeks designed their foliage from the acanthus and honeysuckle; the Romans from the acanthus, the vine and the laurel,—and we should take, not the foliage of other lands, but like our fathers of old, the foliage of our own, and make our architecture characteristic of ourselves and our country, by using the thorn, the maple, the oak, the thistle, the briar and rose, the clover and fern, with all the countless and simple leaves and flowers which so luxuriantly enrich our fields and hedges.

Now although sculpture in its highest branches has been closely followed by modern English artists until such names as Gibson and Bailey have gained a world wide reputation; yet sculpture of a lower class,—architectural sculptured decoration has been woefully neglected. It has not been considered worthy of attention, but has been treated as beneath the notice of the artist, who has aimed entirely at the highest class. Classic and Medieval foliage has been looked upon as perfection, and the architect instead of designing has been content to take it as he finds it—merely copying out of some book, or leaving it altogether to the unskilful hands of an ordinary workman, to whom he has perhaps given a few *aguettes* from which to copy. But of late years the necessity has been pretty generally felt for making new designs for foliage and endeavouring to strike out something fresh,

instead of resting satisfied with copying and recombining from that which has been handed down to us. It has been at length acknowledged that we must again have recourse to the fountain-head—nature—from which all conventional forms of foliage were originally derived; and I believe it is generally allowed, that we cannot proceed far in the pursuit of beauty without her aid. All that we see most to admire in the foliage of the Classic or Gothic eras can be clearly traced to natural forms and natural arrangement, and by studying how nature has been hitherto followed we are enabled to perceive how to improve or vary our ideas, and to take advantage of other beauties which will be sure to spring up before the eyes of the diligent student. Probably in pursuing his studies he may find much that is exceedingly simple and not new, still as every arrangement, simple as it may be, forms one in a regular chain of natural development—and, as it is in following up this chain and supplying by degrees link after link, that he gains that true feeling and knowledge of those natural laws of which he is in search—nothing should be considered too commonplace for study and examination.

The geometrical arrangement and form of flowers are very interesting and beautiful. Flowers which radiate from a centre are arranged upon the triangle, the square, the pentagon, the octagon, and other regular forms, and the precision and regularity with which this disposition is sometimes carried out is very remarkable. Several diagrams of flowers of this kind are before us, which I will now proceed to explain. The common white lily is formed upon the triangle, and when viewed directly in the centre of the flower its general form immediately suggests the six-pointed star, with which I have surrounded the flower in the diagram. Commencing with the seed vessel situated at the bottom of the flower (and which is the very centre of all), we find it arranged in three heart-shaped cells, as seen in the section through the seed vessel, shown on the left of the diagram: each cell contains two seeds (it contains in reality a great many more, but two in each cell, that is one layer, are all that can be seen at one time in section), from the seed vessel springs the style the end of which is again triangular, answering to the cells of the seed vessel. The general appearance of the seed vessel or pistil, after the petals have fallen off, is seen at the right of the diagram, and in the centre of the diagram of the flower the triangular end of the pistil is again seen, around which are arranged six stamens in two triangles of three each, the first three alternating with the pistil, the second three alternating with the first. This is better elucidated by the figure at the top of the diagram. Outside the stamens and alternating with them issue in a bell-like form, the first set of three petals, and alternately with them the second set, which completes the flower. Nothing could be arranged more simple or graceful, nor could anything be more appropriate than the selection of this flower as the emblem of purity. The general bell form which is not shown in the diagram is also well worthy of study.

There are many other flowers which are arranged on the same principle as the lily—as, for instance, the crocus, the snowdrop, the daffodil, the tulip, the wood anemone, the jonquil and the iris. It is perhaps somewhat singular that they are nearly all early spring flowers—the crocus and snowdrop being the very first to thrust forth their blossoms to show us that winter is departing—thus appearing to answer to their simple and primary arrangement upon the triangle, the first geometrical figure. The lower figure in the next diagram shows the arrangement of the jonquil with two sets of petals as in the lily. These were the type for flowers in Gothic architecture in diaper work, spandrels, and many other positions where the triangular arrangement is most suitable. There are numerous examples of the triple arrangement, which was always, from its emblematical meaning, a favourite among Mediaeval architects. In the iris or fleur-de-lis there are six petals as in the lily; three turning upwards and meeting together in the centre, while the other three turn downwards and give the lower lobes of the conventional fleur-de-lis, shown on shields or in painting in the flat, consisting of three parts only, the centre and two side lobes. It is often executed in this manner

when isolated and in metal work, the triangular formation with all the six petals as in nature, which could not fail to add much to its beauty, not being preserved. In the wood anemone we find a very elegant triple arrangement. The natural flower has an involucre of three leaves, issuing at one point about 2 inches below the flower, which, when seen from above, presents the appearance shown in the diagram. The flower consists of six petals alternating as in the lily. This alternating of one series of petals with the other, and of the leaves of the stem again with the petals, and also with each other, is a universal law in nature, which, except from accidental circumstances, is scarcely ever departed from. The involucre surrounding the flower is formed of three triple leaves, each leaflet being again subdivided into three—the points into three again—the side points into two. The flowers of four petals are not numerous; most of them are very small, and often appear in bunches and clusters, forming the natural order of Cruciferae, and are the flowers of the cresses in our gardens. The wall flower is one, but perhaps we see the cross form better in plants and trees having opposite leaves. That is, a pair of leaves issue from the stem at the same level but from opposite sides—the next pair growing at right angles to them, so that when we look upon the top of the branch it presents the cruciform arrangement shown by the branch of lilac—which is a natural representation of a branch as seen when looked down upon. The arrangement of the buds is shown at the side. There are many other plants and trees which grow in the same manner—as the maple, of which a diagram is given, seen upon the top of the branch—the privet, the ash, the horse chestnut and nettles, besides many others. The most common arrangement, however, is that of leaves springing out alternately from the stem, as in the oak, the thorn and a vast number of both trees and plants. The fuchsia, which is a very elegantly formed flower, often hanging in very graceful, pendulous clusters, has also a cruciform arrangement; the most ornamental portion, however, of this flower is the calyx, and not the corolla as is usual. The flower, as seen by the eye looking up, is shown in the lower corner of diagram. The leaves of this plant are also opposite. The cross form seen in opposite leaves is probably the type of the four leaved flowers in diaper work, cornices, and bosses of the fourteenth century. The drawings of two bosses show conventional arrangements from the lilac and the maple, the latter having the key seeds brought in at the angles. By far the most common number of petals in flowers is five, as in the common briar and dog rose. In the garden convolvulus the pentagonal form is very beautifully developed by the general form and the scarlet five-pointed star on the rich purple ground—but the flower is not divided into separate petals, being “monopetalous,” that is, in one single bell or rather trumpet shaped form. In the woody night shade, which is a small purple flower with a yellow centre, the five-pointed star is most mathematically developed. The points are laid flat in the diagram—the natural representation of the flower as it grows is shown in the right corner. The primrose has five heart shaped petals of a pleasing form. The hollyhock has five petals joined at the base, each deeply overlapping or revolving one upon another—when in the bud they are quite screwed round. The apple blossom consists of five petals with the green calyx behind just appearing between the petals. The section of an apple shows how the pentagonal form is still carried on in the arrangement of the seeds. In the strawberry blossom five delicately white heart shaped petals are barely attached to the centre, shewing the five green points of the calyx very plainly between them. In the campanula, or bell flower, we have a very elegant pentagonal form, and in the double one, as in the diagram, a ten pointed form. In the stellaria, or stitch wort, we get a very star-like form, as its name indicates—each of the five petals being nearly divided to the centre into two parts. The *coronopsis* has eight petals, each with triple ends. The pilewort crowfoot has also eight petals. The last flower to which I would draw your attention is the moschatell, or *adonis moschatellina*, a rather long name for a little simple weed which scarcely grows more than 2 or 3 inches in height, and the flower is almost

imperceptible from being nearly of the same colour as the leaves. It however deserves minute attention from its very curious construction. It has five small flowers joined together in one head; four of them, of five petals each, are set in the form of a square, and upon them, on the top is set another flower of four petals only. The leaves, which are triple, are of very elegant form, and each leaflet is again subdivided into threes.

It may be supposed from my bringing such an array of natural flowers and leaves before you, that I am advocating a literal translation of them for the purposes of architecture, and that I wish all foliage to be strictly natural. Nothing however can be further from my intentions. Natural foliage, however well rendered or cunningly carved, if merely copied from nature without being translated by the mind of the artist, will fail entirely in its purpose, and be less effective than the literal copyism of the foliage from any of our architectural precedents. This cannot be too strongly insisted upon, because if we tell our artists that they should not copy from old examples, but simply say, as it has often been said, that they should "go to nature," we shall soon be so deluged by literal representations of natural foliage that this system of copyism will become worse than the first. In the rendering of natural into architectural foliage there must be study and thought—life and beauty. It must be the creation of the artist's mind, working upon nature's principles and nature's laws.

The purpose of these diagrams is to show that nature is ever fruitful in change, combined with the utmost simplicity—while in modern ornament, the reverse is the case, and there is constantly a want of change with the greatest intricacy. We see also that nature is constantly regular and geometrical. What can be more in accordance with architecture? We can alter and conventionalize in any manner we please. We need not copy, for we can produce changes by substituting leaves of various forms for the simple petals—thus we can substitute the triple leaf for the plain petal, or put leaves together after the manner of flowers, as we see in nature when looking on the top of branches, such as the lilac and maple. Great prejudice exists among many against adopting the natural form of a leaf, and many architects extol what they choose to call "purely conventional foliage" as being far before the natural—although really all must be natural that retains any character worth preserving.

In the treatment of foliage several things must be considered—in the first place, the general arrangement of the leading lines, which must be purified from all inelegant forms, and be such as will best harmonize with the architecture which surrounds the composition. Next, the material, its texture and colour, and the breadth of form and depth of cutting must be suitable to it. What is suitable and appropriate for a rough-grained stone will not answer for a fine one, and so on. Then the position is to be remembered, and whether the architectural member which the foliage enriches requires it to be of a flat character, or otherwise. What is suitable near the eye must be simplified according to its intended distance or height. Then the light and shade must be studied, which must above all be carefully and duly balanced, while the form of the leaves and foliage requires the greatest consideration; and as among natural leaves and flowers we find some of the most pleasing and elegant forms which can be conceived, it is perfectly legitimate to take advantage of them. For example, it is utterly impossible for man to invent a more elegant form of leaf than that of the maple, yet whilst applying it to his own purposes, it is not at all necessary to adhere strictly to nature. It can be made more symmetrical and regular, until it becomes a purely architectural leaf, based only upon that of the maple. The first time that I observed such foliage, now nearly twelve years ago, was at Southwell Minster, when I caught sight of the ornament in the arch of the doorway leading to the Chapter House through an open window, and I was so struck with its delicate crispness of form, and its wonderfully artistic balance of light and shade, that I have a vivid remembrance of its effect to this very moment. It had no confused appearance, no straining after light and shade by the contortion and twisting

of the surface of the foliage, nothing to disturb the repose of the architecture; all was bright and sparkling, teeming naturally with the life stamped upon it by the hands of the mason nearly six hundred years ago. It is not a literal copying of nature, but there is life transplanted there from the very hedges and fields, that surround that old Minster, which still continue to burst forth in Spring, and to develop and expand the same forms which were expanded under the eyes of the workmen of this very doorway. We can still see there what these old masons admired, the beauty they sought after, and how they have shown in stone their love of their native land, and of their own simple native foliage. The very stone has written upon it, "My son, your fathers have wrought thus with their hands, go thou and do likewise,—copy not our works, but go to the source which thou seest we loved—study as we studied the works of thy Creator; and, moreover, make thy work characteristic of thy country, which thou should'st love, and thy day which thou should'st stamp as thine own." What would it have been if these old artists had worked as we have been working, literally copying Greek and Roman foliage—exotics which do not belong to us? We should have seen nothing to admire, but rather a puzzle for the antiquary, as our own age probably will be in six hundred years time, if any of the modern classic work lasts so long.

The forms of leaves vary from the most simple to the most complicated,—yet even in the most complicated, there is such a simplicity and beauty of arrangement that they can be often altered or adapted in the most happy manner to suit the purposes of the carver, without losing sight of their natural formation. Briefly to explain, I would refer to the diagrams of leaves. First, we have simple forms, as in the woodbine, the lilac, the violet, and many others; next we have the leaf divided into three pointed lobes, as in the hepatica—three round lobes, as in the water avena, or herba benedicta, which is said to be the type of the early English foliage; then we have the three distinct leaflets, as in wood-sorrel, clover and strawberry; and three three-lobed leaflets, as in the creeping crow-foot; and while in the parsley leaf this triplicity runs into the greatest apparent intricacy, still it is nothing more than the same principle carried to a greater number of divisions. First, there are three stalks which bear each three distinct leaflets, divided into three lobes, each lobe again divided into three. Much the same arrangement is seen in the leaves of the moschatell and wood anemone, to which I have already referred, but they are less divided than in the parsley. Thus we see a natural principle of continually dividing and sub-dividing into threes, which is not confined to one particular plant, but runs, in various ways, through a large number, any part of which we can adopt or modify for our purpose without copying from any one leaf in particular. Other leaves are divided into five lobes, as the ivy, the maple, the vine, the bryony, and the hop,—these run again into sub-divisions, in the same manner as the triple leaves. The oak and the thorn present a wonderful variety of forms in themselves, the thorn having sometimes three lobes, five lobes, seven and even nine lobes; and in the thistle, we get a leaf of a beautiful sharp and pointed form, which is cut into many lobes. Another kind of leaves are those which have a number of simple leaflets, in pairs, upon a central stem, with an odd leaflet at the end (called pinnate), as for example, the elder and the rose, which have five or seven leaflets—and the acacia and the mountain ash, which have a large number—somewhat after the same manner as the ferns.

I would point out that there are certain natural principles and forms running through both leaves and flowers—that they follow a regular geometrical distribution of parts, and that the form of the leaf or flower follows naturally from the principle, or, if I may so say, the anatomy upon which it is set out—thus flowers radiate in threes, as the lily; leaves grow in threes from the same point in the stem, as the anemone; leaves divide and sub-divide in threes, as we see carried to the greatest extent in the parsley. Flowers again are cruciform, as the wall flower; leaves also grow with the same

arrangement, as we see in the lilac and the maple. Flowers are very commonly divided into five petals; leaves are divided into five lobes with a semi-radiation, simply cut out as the ivy, divided with eyes as the vine, which we see again in the flower of the hollyhock. The lobes deeply divided as in the maple and the bryony, or sometimes separated into distinct leaflets as in the horse chestnut and the Virginian creeper. Then we see the leaf take leave of radiation and branch as in the rose-leaf, which is carried further in the acacia and the ash, and is again sub-divided in the ferns. In the leaflets of the acacia we see also the heart shape which we observed in the petals of the strawberry and the primrose; also again in the leaf of the violet, but formed the contrary way.

All these facts show that there are certain natural laws, by studying which the artist can produce what form of leaf may best suit his purpose, but without following any one leaf in particular; thus giving him such a vast field to work in that there need be no limit to genius or invention.

In the foliage of the best periods, as in the oak stall work at Winchester and Wells, and in the little Chapter House at Southwell, the outline and form of the leaves were carefully attended to, and, in spandrels and other panel surfaces, always arranged in a flat manner. The surface carving upon the leaf was made quite secondary, and never sufficient to interfere with or disturb the flat surface which it enriched. If a leaf is beautiful in form, it requires no violent undulation upon the surface, or deep gasches and lines cut upon it to produce light and shade; such a system defeats the object of the artist, the form of the leaf is lost, the high lights become small and thin, the shadows behind the leaf become mixed in effect with those upon it, and the whole has a disagreeable confused effect. Yet this is the system of modern carving, be it Classic or Gothic. It is bad and vicious from beginning to end, nothing is studied, nothing is thought of but vulgar, violent contortions, or abominable liny surfaces. I was told by a modeller who had been executing some foliage from my designs, and had tumbled it about like the sea in a storm—"if you want it all flat in that manner, I can easily do that—that's much easier for me, but I wanted to give you more effect." Our modern carvers are always talking about "effect," but seldom hit the mark. This was Classic work, but I have experienced equally unsatisfactory results in Gothic carving—parts were so turned and twisted that I scarcely recognized my own designs. The modern carver believes that all this contortion and deep gasches give effect—he will not let well alone, and the forms and lines which you study he buries in oblivion, giving nothing but quietness where you sought repose and architectural enrichment. Set a man to carve a Corinthian capital and he cuts it up as shown by the leaf on the right of the diagram. He takes the most complicated form he can find among ancient examples, and then proceeds to carve up the surface with innumerable deeply cut lines to make it "effective." The leaf on the left shows the manner in which I consider it should be cut—simplify the outline and then preserve it, do not bury it up again by manufacturing shadow upon its surface,—shadow is required behind the leaf and not so much upon it.

Modern carving then should be based principally upon nature, but we should take ideas from all that is most beautiful, from all periods and all styles of architecture, only let us not confine ourselves or copy from any. Its leading characteristics should be elegance of form and beauty of light and shade, whilst retaining all the quietness and repose necessary for its various positions as architectural enrichment. Let us all thus work together; let the sculptor and painter remember that architecture is their sister art, and render her willing assistance. Let the working man educate himself to become the zealous art workman. Thus let all endeavour with heart and hand to produce a style worthy of our age.

The Chairman, Mr. KERR, Fellow, said, that the meeting had listened with great pleasure and attention to the explanation which Mr. Colling had given of the result of his study of natural foliage. The subject was a very interesting one in the present phase of architectural art, which depended so much upon a proper comprehension of the picturesque. There was certainly nothing in nature which exhibited the manifest intention of the designer so much as foliage and flowers. The beauty of a landscape might be said to be almost a matter of accident, but the beauty of a flower displayed the deliberate design of the Divine hand, exercised for the purpose of producing a special effect of pleasure in the mind. These works were peculiarly available to the artist, because, in the formation of them, their Divine Creator was carrying out the very process which the artist was called upon to carry out for the contemplation of other minds. In considering the purpose of the Divine designer in the forms of foliage and flowers, it would be seen at once that the leading ideas were variety and beauty. In respect to flowers (as indeed with all other natural objects) variety was attained by irregularity, based upon a system of regularity. Mr. Colling had pointed out that all natural productions were based upon what, for the present purpose, he had properly called geometrical principles, or geometrical forms. But there was another principle always at work in nature. Regularity was carried out with, he might almost say, invariable irregularity: as they had been accustomed to say at school, that there was not a straight line in nature: and in foliage there were two principles in constant operation; one being the regularity with which every object had been studied, the other the irregularity with which it was developed. Now in architecture they had the Classical or severe school of design, and the Gothic (or Mediæval) or picturesque school. The latter had variety with less regularity or unity than the former. The Classical school had unity, but less variety than the picturesque. He need not say that, in adopting the natural forms of flowers for architectural purposes, it was necessary, to a certain extent, to artificialize them; and in the Classical style this was more necessary than in the picturesque. The student of severe or Classical architecture (he did not apply that term to the Renaissance) would endeavour to conventionalise his forms into a perfectly geometrical development, whereas the student of the Mediæval style would study more particularly the picturesque which already existed in natural foliage. Mr. Colling had not happened to mention the question whether colour could be properly introduced in architectural carving, but no doubt he would have thought it only necessary to say, that as coloured sculpture was of no greater value as a work of art than wax work, so coloured flowers or foliage in architecture would not have that sculptural character which was required in architecture. Occupying the chair, as he then did for the first time, there was one observation made by Mr. Colling which he could scarcely allow to pass unchallenged, namely, that the architecture of the present day would be a puzzle to the antiquary of the future. The present was a *period* as well as other periods. It was a part of that *modern European period* which commenced (with what we call the revival of art) in Italy, in the fourteenth and fifteenth centuries, and modern architects generally were carrying out, more or less, the principles which were then first evolved—principles which must be carried out of necessity, until some other system should overthrow the present in its turn. They were, in fact, (when not copying) but carrying out the natural style of the modern European or Italian period, and in proof of this he was glad to see that the Gothic architects of the present day were coming nearer and nearer to the Italian style of treatment. The pains which Mr. Colling had taken to explain the natural forms of flowers and foliage were very creditable to him. It showed that the anatomy of botany was a subject particularly worthy of study, as it would show the principles upon which natural foliage had been designed. There must be a law in this subject as well as in everything else, although they might not be able to dive so deeply as might be wished into its principles. Nature was infinite in its variety, and therefore by laying before them for imitation this

infinite variety, called upon them to carry that infinity into still greater infinity, if he might say so much without getting confused in metaphysics. In exhibiting to them the road to infinite variety, Nature called upon them most manifestly to progress in the same direction, and he was quite satisfied that no one would find the subject of botanical form other than exceedingly rich in respect to design and variety. The study of the anatomy of botany, as Mr. Colling had very properly observed, was the only thing which would produce *spirit* in carving. Some were apt to confuse carelessness with originality; a most fatal error, for carelessness never could be but antagonistic to originality. True originality must lead to study and care; the great end and object of all study being not to produce copyism, but to discover the principles upon which originality might be based.

Mr. COLLING said that he considered Gothic architecture embraced both the picturesque and the symmetrical. Most of the illustrations he had produced showed that the geometrical or symmetrical arrangement of ornament suited what he had been explaining quite as well as, if not better, than the picturesque; and he could easily conceive the same principle to be carried out through a noble Gothic building, to suit that style quite as well as it would the classic.

Mr. C. H. SMITH, II.M., said that as the only representative present of the body of Architectural Carvers he could not be silent on this occasion. With respect to the drawing of carving in Southwell Minster, referred to by Mr. Colling, it was carved in the same stone as that used for the New Houses of Parliament, and was one of the original examples to which Sir C. Barry and himself had paid particular attention. Their opinion (and the same remark was made by other architects) was, that although it was wonderfully well undercut, it was so exceedingly flat on the surface as to display little or no feeling. It certainly was not executed in the style in which he should himself have carved it. Mr. Colling's remarks on architectural carvers led him, Mr. Smith, to observe that, during the last thirty years, he had had a great deal to do with architects in reference to carving, and his experience was, that every one appeared to criticize and severely blame all that the others did, and what one admired another condemned. With respect to Corinthian capitals he had carved more than most people, and he never executed one without having a most minute and careful drawing to work from. In fact the detail was not left to the carver. In the case of one celebrated building in London, however, the architect had refused him a drawing, and had told him to copy the capital from the Arch of Hadrian, in Stuart's Athens. Notwithstanding his remonstrances against the outrageous projection of the pilaster capital over the shaft, as compared with that of the column, the architect paid no attention and still refused to look at the drawings: the consequence was that several of the capitals which were in progress were rejected, whilst the building presented some of the capitals as originally executed, and others after the discovery of the error; in some cases one of each came close together, and differed four inches in projection. He mentioned this to shew that the practical man, the carver, was not always to blame. The building he had alluded to was the National Gallery, and the difference in the projection of the capitals of the pilasters might be clearly seen by any person going from Pall Mall eastward. With regard to Gothic carving it was very rarely that the architect left it to the carver; although generally speaking he found that the public and the profession were most pleased with those works where the architect had interfered but little. Of course where there was a large amount of carving (as in Southwell Minster, and in the New Houses of Parliament) it was impossible for the architect to make drawings for the whole.

Mr. COLLING said that he had not intended to hold up the flat style of ornament from Southwell Minster as an object for imitation. He went upon the principle of copying nothing. He did not consider it indeed perfection, but his first impression had been that it was the most beautiful Mediaeval carving he had seen. The remarks of Mr. Smith shewed the want of a class of artists who

should take up architectural carving in a proper spirit, and independently of architects. He had already expressed his regret that sculptors had devoted their attention to the highest class of art and neglected architectural sculpture.

In reply to the Chairman, Mr. COLLING stated that he decidedly advocated the simpler form of leaf in the Corinthian capital, as shown in his drawing; and he considered his opinion to be borne out by the successful effect of those in the new works at the Louvre. The leaf there was almost perfectly plain, receiving the full breadth of the light, which was not cut up by thin lines so as to be mixed up with the background which was intended to relieve it. Of course a proper medium should be preserved, and much would depend upon the height and position of the column.

Mr. M. D. WYATT, Hon. Sec. rose to draw the attention of the meeting to the obligations they were under to Mr. Colling for his very suggestive paper; which was the more interesting, considered in connection with that which had been read at the last meeting on the New Houses of Parliament, and with the school of architectural carvers, which had grown into importance in the elaboration of that vast building. It was impossible for any careful observer of the progress of architecture in this country, not to feel some anxiety with respect to the influence those artist workmen would exercise upon whatever style of design might be hereafter inaugurated in this country. Numbers of the workmen who had been so long employed at the Houses of Parliament, and others no less dexterous, were now scattered about the country, and had been employed in ornamenting numerous parish churches and other Mediaeval structures with sculptured decoration. Many details, involving in their successful execution considerable knowledge of both natural and architectural enrichment, were left to the actual design of these workmen, especially in country places; and it was, on that account, most important that sound principles should be recognized to serve as guides for them. It was, in this respect, that the subject of Mr. Colling's paper was exceedingly valuable at the present time. Every one must feel, with Mr. Colling and the Chairman, that the normal principle in nature's products of all kinds, was regularity. The perfection of its symmetry was indeed the test of the health and value of a plant, for the moment disease occurred, the regularity of the plant or flower was impaired. It appeared to him, however, that there was in nature a continual effort to escape from the monotony that would be engendered by a too prominent and constant assertion of a despotic principle. The operation of the laws of gravity upon the flowers or plants, and the wayward efforts they were continually making to reach the purest light and air, produced incessant counteractions to any too great severity of form in growth. The way in which leaves sprang from their stems, and branches from their parent trunk, showed, by their irregularity, a settled purpose in nature to assert her freedom from what would otherwise be too great rigidity and simplicity in the main geometrical forms to which she would be limited but for this gasping after liberty. Her favourite principles should be carried out with veneration in art, and thus designers should endeavour to contrast dominant geometrical forms with those on which the fancy of the artist was employed, either in direct or conventional imitative art. He agreed with Mr. Colling that it was by the adoption of the general principles of nature in connection with pure geometrical forms, in parts, and for contrasts, that they should obtain the best architectural rendering of foliage. The tyro commenced invariably with a tribute to the predominance of rigid order in design—with a central line, and equally balanced ornaments on each side. He soon found this too easy, and endeavoured to escape from such simplicity, degenerating into insipidity; but as he became master of greater resources in composition, he obtained an almost equal, but less obvious, degree of regularity, producing the happiest effects, and at the same time constantly concealing from the uninitiated the precise means by which the especial graces had been obtained. This was the practice of all the greatest painters. The best compositions of Raffaele, the Cartoons for

example, were almost invariably based upon some simple geometrical figure; but by the great dexterity of the management of subsidiary lines, of colour, and of the light and shade, there was a constant hiding of the first intention; and the spectator was pleased with an effect of order and balance of parts, although unable to trace without a happy and sustained mental effort, how such regularity had been obtained in what at first sight appeared so free and unartificial. The "*ars celare artem*" was indeed one of the most important branches of design, inasmuch as it involved the most perfect imitation, and at the same time forbade the artist's bringing himself conspicuously forward.

With regard to the extent to which the direct copying of natural forms might be allowed in sculpture or architecture, a great deal depended on the material employed. The imitation of the trunk of a tree in oak, or of rocks in marble, was objectionable; but a very close approach to direct imitation might be made where the object was enclosed by architectural forms obviously conventional, as in the case of the mouldings dividing the foliage at Southwell Minster. Although the foliage in that case was closely copied from nature, the fine projecting beads and rolls separated the ornaments from each other, and at once convinced the spectator of the architectural character of the work. Direct imitation of nature might also be allowed where the scale of the imitation was less than that of the original, because the difference of scale at once showed that the work was not a mere portrait, and it therefore lost its servile character. If they were to insist too largely upon convention, they would do away with one of the greatest and happiest privileges of the artist. No delight was greater to him than to bring eye and mind and hand to bear in imitating and endeavouring to re-produce in equal perfection any beautiful object which he might select; and in precise proportion to the pleasure felt by him in working was almost invariably the pleasure conveyed to the spectator by the beauty and perfection of the artist's imitation. The bronze foliage and little birds of the architraves of the gates by Ghiberti, at Florence, were admirable examples of the most conscientious transcribing of nature. It would be impossible for her to imitate herself more playfully and honestly than Ghiberti had done. There was not a plant in his work retaining its normal geometrical structure, and it therefore harmonized most agreeably with that infinite change and variety which are no less constant phenomena in Nature than the order and precision of her fundamental laws.

With regard to the application of colour to sculpture, Mr. Wyatt thought he must join issue with the Chairman. He agreed that party-colours were inapplicable to the highest class of sculpture, unless managed with consummate dexterity; but in ornamental compositions, where there might be two or three systems of lines, interwoven with others in different directions, the intersections recurring at regular intervals, there could be no objection to the application of various colours to each system of lines; and if it were desired to place ornaments in different parts of the spaces formed by the intersections, those ornaments might also be uniformly coloured, so as to give the effect of regularity by repetition. With regard to any such applications of colour, they must obviously vary according to locality;—thus it was evident that, in a ball room, a much nearer approach to what the Chairman termed "*wax work*," might be allowed than in a church, or other building devoted to more serious purposes. If, indeed, sculpture were introduced into any highly decorated building, and from such it could scarcely be banished with propriety, it would be unwise not to carry some degree of colour into it, so as to bring it into harmony with that by which it might be surrounded. Mr. Wyatt concluded by proposing a vote of thanks to Mr. Colling for his highly interesting paper, and for the beautiful diagrams by which he had illustrated it.

The vote of thanks was carried unanimously, and the meeting adjourned.

"ON WATER SUPPLY TO TOWNS."

A Communication from SYDNEY SMIRKE, A.R.A., Fellow.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, Feb. 22nd, 1858.

79, GROSVENOR STREET,
February 22nd, 1858.

DEAR SIR,

Permit me to invite the attention of the Members of the Institute for a few minutes to a subject—humble, indeed,—most unattractive, and most anaesthetic, yet a subject which, being of great economic and sanitary importance to the public, need not be considered unworthy of the attention of any man, still less of the Institute of British Architects.

In very few large towns are the inhabitants able to indulge in the use of an *unlimited* quantity of water. The wasteful, and indeed, dishonest, practices of many often preclude the possibility of this indulgence, even when the natural supplies of water do not set a limit on its use.

In places, as in London for example, where the service of water is necessarily confined to a short period, daily, it becomes a matter of very great importance to provide in each dwelling receptacles large enough to meet liberally all the reasonable wants of a family for at least twenty-four hours: there are in truth few provisions of equal importance to public health and comfort. Yet, I believe, that an enquiry into the actual state of things would shew that not only are these receptacles in the dwellings of the humbler classes *far too scanty*, but in a multitude of cases *wholly wanting*. It is in the hope of suggesting some alleviation of this evil that I beg to address these few remarks to the Institute.

As far as I know, there are but three kinds of cisterns in general use. *First*, there is the water butt; a rude and primitive contrivance, insufficient in capacity, and liable to speedy decay, and in its decay destructive to the quality of the water, causing it to teem with all manner of noisome creatures. *Secondly*, there is the *lead* cistern; a very costly receptacle when substantially constructed, and one which is liable to the serious objection of very frequently poisoning its contents. *Thirdly*, the slate cistern; a vast improvement upon its predecessors, and a contrivance with which we might well rest contented, were its costs such as would admit of its general adoption in the humbler classes of dwellings. The purpose of my communication is to suggest a *fourth* material, and to press upon manufacturers the expediency of their at once coping with and overcoming the practical difficulty of making cisterns of a *strong, coarse, earthenware, of ample size and at a very low price*. I will not suppose it to be beyond the reach of manufacturing skill to supply the great desideratum. I have seen and measured earthenware cylinders 2 ft. 5 in. in internal diameter, forming the lining in a well more than 2000 years old, amidst the ruins of ancient Selinuntum, and these cylinders were as sound and as serviceable as when first made.

Is it unreasonable to expect that the makers of clay in the 19th century might improve a little upon the potters of Magna Græcia?

Surely we ought to excel the ancient Greeks in manufacturing skill, although we may have to succumb to them in aesthetics?

A vessel of this material 3 feet square and 4 feet deep would hold upwards of 220 gallons. What an immeasurable benefit would be conferred on the poorer classes if such a vessel could be

supplied at a cost within the reach of their purses! Even if their means were too scanty to admit of their paying water rates, such a reservoir would be of signal service were it provided merely to receive rain, which comes down to us for nothing (except, indeed, our *thanks*, and even that is a debt not always paid). But I will not admit of the plea of poverty; for I doubt whether any one who cannot pay some moderate water rate ought to hold a house at all. Consider the cheapness of water. I have the best authority for saying that at least one great Water Company in London supplies a thousand gallons for sixpence. Therefore in a house containing ten persons, each of whom is supplied with ten gallons daily, the company's charge on that house would be $\frac{1}{10}$ of a penny, that is to say $\frac{1}{88}$ of a penny for each person for ten gallons. Whereas each of those persons would pay about thirty-four times as much for a single pint of poor, unwholesome, beer. In other words, bad beer is about 2700 times dearer than good water. I may add that in the event of any great extension of the supply of water, it does not seem unreasonable to anticipate a *still lower* rate of charging, at least to the poorest class of customers.

I hasten to close my remarks, but before doing so, I would venture to throw out, in the form of a query, another suggestion.

Why should not the supply of water to a house be made compulsory?

I do not see that it would be more unconstitutional, or arbitrary, to do so, than to make the supply of light and air to a house compulsory, which the Building Act does. So also the Legislature has not hesitated to make it compulsory on all builders to form drains. Ordinary paving and lighting rates are in fact compulsory charges on individual householders for the public good. It is true that, were such a course adopted, it would become necessary, in order to prevent Water Companies from abusing their privileges, to controul and limit, by enactment, their rates of charging; but no company would venture, I apprehend, to object to such a limitation, were every householder compelled to be a customer.

The quantity of water required to be supplied would probably be graduated according to the size and rent of the house, but I submit that to compel by special legislative enactment, a reasonable quantity of water to be provided in each house, would be a most salutary exercise of that power which a Government holds *only* for the public good. The larger a city becomes, and the greater the aggregation of its inhabitants, the more urgent becomes the duty of the Legislature (I say it with great deference) to provide, by stringent measures, and by a vigilant controul, for the health and well being of the people.

I am, dear Sir,

Very faithfully yours,

SYDNEY SMIRKE.

C. C. NELSON, Esq.

&c., &c., &c.

ON THE APPLICATION OF HYDRAULIC LIMES AND OTHER CEMENTITIOUS MATERIALS TO CONSTRUCTIVE PURPOSES.

By G. R. BURNELL, C.E.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, Feb. 22nd, 1858.

IN the very interesting paper lately read here by Mr. Boulois, and in the course of the discussion which ensued upon it, some incidental remarks were made upon the use of concrete in foundations, which appear to merit more attention than they received at the time. Moreover the evidence which was lately given before a coroner's jury, upon the occasion of an enquiry rendered necessary by the fall of a chimney, displayed so strange an amount of ignorance of the real philosophy of the use of concrete on the part of a practical builder, who seems to have been of average ability,—an ignorance, it is to be feared, shared by far too many of our so-called practical men,—that I have ventured to bring the subject before you again, with the hope of being able to induce you, and the members of the profession generally, to examine it anew. In other countries this has been done very carefully and very successfully. Perhaps, therefore, a brief record of the recent investigations and of the experience of Foreign and English Engineers and Architects may suggest both, what is still to be learnt, and what to be avoided, in the future researches to be made.

As it will be necessary in the following notice to allude to some controverted points of the chemical theory of limes and cements, perhaps I may be allowed briefly to state, even at the risk of going again over well trodden ground, the opinions which are now generally held upon that theory, before describing the works recently executed.

The objects for which limes and cements are used are, as you must be aware, firstly, to connect together the small materials used in building; or, in other words, to produce artificially monoliths of the size and shape required in any particular case; and secondly, to form preservative coatings upon the exposed surfaces of more perishable materials. It follows, therefore, that the qualities to be desired in a lime or cement are, that they should unite energetically with the bodies they are intended to join together; that they should set rapidly; and that they should attain within a very short period of time a sufficient degree of hardness to enable them to resist external causes of decay. In addition to these theoretical conditions must also be named the economical one; and it, therefore, should be considered that the previously cited advantages must be attained in conjunction with cheapness as to the first cost, and to the application of the materials. It is, in fact, this latter consideration of economy, which has determined the preference of architects and builders for the cementitious materials with a lime base; for otherwise it may admit of question whether bitumen, silica, iron, or other bases, might not yield cements of superior quality to those now generally employed.

At a very early period in the history of architecture the use of bituminous and lime cements appears to have prevailed; though some of the boldest Pelasgic, and some of the most perfect Greek and Roman works were actually built without mortar of any kind. The Romans, however, used lime in most of their great works; and they were also well aware of the extraordinary property possessed by puzzolano, of increasing the rapidity of setting, and the hardness of the lime, with which it was mixed. During the Empire and the middle ages, the art of mortar and concrete making, as practised by the Romans, was preserved; and indeed, although the use of concrete had been forgotten here, subsequently to the revival, it appears never to have been lost abroad. But even whilst thus practising upon a large scale the conversion of limestone into lime, with a view to the reconstitution of a solid

homogeneous cement, the builders of former days paid little attention to the scientific principles involved in the operation. Smeston indeed made some very shrewd guesses at the real facts of the case; and subsequently other chemists and engineers made advances towards the real scientific explanation of the phenomena attending the use of lime; but it was not until M. Vicat commenced his researches that any exact, or philosophical views upon the subject were propounded, or that attention was called to the real nature of the difficulties to be overcome before arriving at any satisfactory explanation of the problem to be solved in the attempt to arrive at a correct theory of the philosophy of limes and cements.

It would be out of place, here, to dwell upon the history of the various descriptions of limes and cements now used, further than may be necessary to explain incidentally the circumstances under which they were introduced; and those of my hearers who may be anxious to study this branch of the investigation, are therefore referred to Mr. Godwin's paper in the Transactions of the R. I. B. A.; to Genl. Pasley's work; to M. Vicat's numerous publications, or to the more recent and more scientific researches of M. M. Kuhlman, Fuchs, Signorilli, Uhagon, Minard, Chatoney, Rivot, &c. But it is important to observe that latterly somewhat different opinions to those which formerly prevailed, with respect to the circumstances under which limes and cements set, have been promulgated; and that the reasons upon which these new opinions are founded are sufficiently cogent to warrant a public examination of the methods of using those materials adopted especially in England, which would hardly have been prudent so long as the theory connected with them remained in its previous state. And as the practical questions involved in the consideration of the actual hardening of mortars are of vital importance to the architect, we ought carefully to examine the suggestions of competent observers, without yielding ourselves too implicitly to their, or to any other, authority. These suggestions may be most easily brought before your notice in a description of the works and the accidents which led to their being made.

Until within a very recent period, then, it was held that ordinary limestones when burnt in kilns parted with their water of crystallization and their carbonic acid, and were thus reduced to the state of an amorphous, spongy material, highly caustic, with a great avidity for water, and of small specific gravity. No change has yet taken place in this part of the theory of limes; nor have the principles enumerated by M. Vicat with respect to the influence of the various substances, in combination with the lime in the natural limestones, been materially shaken. The most competent authorities agree with M. Vicat in attributing the differences in the rapidity of setting of various ordinary limes to the presence, or the absence, of some of the different forms of silica, alumina, magnesia, or iron; or in some cases to a mixture of them all. The chemical combination of silica and alumina with lime in the stone appears to exercise the greatest influence upon the hardening of the resulting limes; or, in other words, the presence of the silicate of alumina in the limestone has been found to have so decided an influence upon the properties of the lime made from it, that the relative quantities of that salt ascertained to be in a stone have been universally admitted as forming a convenient scale for judging of its value as a source of lime. Perfectly pure carbonate of limestones, such as the upper and middle chalk, and most of the marbles, yield in fact a pure caustic lime, whose properties are that it swells when mixed with water sometimes to 2½ times its original volume, and that when in large masses it never hardens; within appreciable periods at least. The presence of a small portion of the silicate of lime in the limestone, (as in the case of the chalk marl) produces the following effects: firstly, that the caustic lime in slacking, or taking up water, does not swell to the same extent as pure caustic lime would do; secondly, that the resulting paste of lime, even when in large masses, will set within comparatively speaking short periods; and thirdly, that it resists the solvent action of running water

more satisfactorily than pure caustic lime would do: the latter indeed would be entirely removed, if exposed to such a test for a sufficiently long period. A greater proportion of silicate of alumina increases the energy of the setting and hardening powers of the lime, as in the case of the blue lias limes; and finally, when the proportions of the silicate exceed a certain point, the limestones in which they exist yield a class of materials called "cements," which set without any marked increase of volume, and rapidly acquire a great degree of hardness, and are insoluble in water.

These various properties serve to classify the limes and cements; for the former are called *rich*, or *poor* according as they may, or may not, swell in slacking; and *hydraulic*, or *non-hydraulic*, as they may, or may not, resist the solvent action of water. The cements are all poor, and most of them are permanently hydraulic.

It is found that so long as the limestone does not contain more than 10 per cent. of foreign matters, the lime it yields is rich, and non-hydraulic. When the foreign matters exceed 10 per cent. the lime becomes more and more poor; but if the foreign matters should consist of the silicate of alumina, or the silicate of magnesia, the hydraulicity increases in proportion to them. The scale proposed by M. Vicat for the classification of these materials is based upon these principles, and it is briefly as follows.

The non-hydraulic, or rich, limes contain under 10 per cent. of foreign matters.

Hydraulic limes contain	clay 10 per cent.	lime 90 per cent.
" " " " " " " " " " " "	20 "	80 "
" " " " " " " " " " " "	30 "	70 "
The extreme, or limit, is	34 "	66 "
Cements contain from	40 "	60 "
" " to	60 "	40 "
Puzzolanos contain from	70 "	30 "
" " to	90 "	10 "

The class of materials last named is a natural volcanic product, and the silicate of alumina it contains is able, when the several materials are properly manipulated, to enter into combination with rich limes, and to communicate to them the hardening and hydraulic properties they themselves do not possess.

Until very recently it was held by most engineers and architects, by myself amongst others, that the solidification of mortars took place in consequence of the absorption of carbonic acid gas by the lime, during the process of crystallization; but it has been fairly objected to this theory, that the quantity of carbonic acid gas contained in the atmosphere, which could be brought into contact with a large body of cement, would not suffice to saturate the latter. The generally received opinion on the subject now is, that limes harden, simply in consequence of the combination with water which takes place during the slacking, and that the rapidity of the setting and the permanence of the newly formed hydrate of lime depends upon its being combined with some other salt: the pure hydrate of lime in fact is soluble; the hydrated silicate of lime is tolerably insoluble, but it forms slowly; whilst the hydrated double silicate of lime and alumina, or of lime and magnesia, are practically insoluble. The facts actually observed seem to confirm these views, and they certainly enable us to account for not only the different modes of setting observable in different limes, but also for some of the more gradual actions which take place in that material, and the effects reciprocally produced by the mixtures of various ingredients. In the case of the now generally used Portland cements, and in that of under-burnt lime, some very curious phenomena may, however, be observed, which appear to indicate that the simple laws mentioned above do not comprehend all the conditions which may arise; so that the

above theory itself must only be considered as a step towards the attainment of a complete one of a more general character. The phenomena to which I thus allude are connected with the obscure subject of the chemical actions which take place under the influence of high degrees of temperature, and we shall have occasion to refer to them in the sequel.

No sooner had M. Vicat published the researches and the experiments, on a large scale, which had led to the formation of his original theories, than a great change came over the practice of architects and engineers in the very important portion of the arts of construction connected with foundations. It was then seen that by using the proper description of lime for the particular position to be dealt with, it was easy to obtain solid, homogeneous bodies of any size which might be desired, by the use merely of small and irregularly shaped materials, and that it was also possible to make, artificially, solid channels or reservoirs which should allow water to flow through, or to be retained in them, without its communicating humidity to surrounding objects. Within a very few years from the promulgation of the discoveries of M. Vicat we accordingly find that the channel of the canal St. Martin was entirely formed of hydraulic lime concrete, in the parts where there was any danger from the infiltration of water into the cellars; the basins for the supply of water in the Rue Racine, and in some of the abattoirs, were also entirely constructed in the same material; and the French engineers universally adopted the system of backing the quay walls of their rivers, or the wing walls of lock chambers, with concrete. In erecting the suspension bridge of Souillac (which must have been executed before 1828, because Vicat mentions it in his "Résumé sur les Mortiers et Ciments Calcaires," published that year, I think that it was built about 1824,) M. Vicat himself used an artificial hydraulic lime, composed of a mixture of clay and of the pure carbonate of lime, for the purpose of forming the concrete used in the foundations of the piers. This work is interesting on several accounts; not only on account of its furnishing one of the earliest instances of the use of artificial hydraulic lime, but also on account of the foundations having been formed in the style described in Mr. Boulnois' paper, now universally adopted by foreign engineers in their bridges, and which Mr. Page was so disgracefully attacked for introducing here. At Souillac, the system adopted was that of driving an enclosure of sheet piling round the intended positions of the piers, of dredging out the interior of the space thus enclosed, and then of filling in with hydraulic concrete through a depth of not less than 16 feet 6 inches of water. It succeeded admirably, although only ordinary hydraulic lime was used in the preparation of the concrete; the term *ordinary* being applied in this instance in contra-distinction to any of the cements.

Between the years 1820 and 1840, the French engineers paid much attention to the preparation of artificial puzzuolanos from brick earth, and many experiments on a large scale were made to ascertain the qualities of the materials so obtained. M. M. Raffineau de Lille, Julien, Bruyère, Raucourt, Troussart, Minard, &c. studied this subject at the same time with M. Vicat, and the result of their investigations was that they considered the lightly burnt clays (which in their normal state are merely hydro silicates of alumina) would produce the same effect in expediting the hardening of limes as the natural puzzuolanos (which are merely silicates of lime affected by volcanic heat) were known to do. There was nothing in this theory to justify any *à priori* doubts of its correctness, and consequently the artificial puzzuolanos were used largely in river works, and in works exposed to the action of sea water. For a time they resisted satisfactorily, but eventually I believe that all the artificial compounds of this description, immersed in sea water, have sooner or later fallen to pieces, and it is now universally admitted by engineers that sea water is able to destroy any mortars exposed to its action, which are composed of ordinary limes mixed with separately burnt clays, whatever may have been the degree of heat it has undergone. The mortars made by the mixture of limes with the

natural puzzuolanos, on the contrary, have resisted this cause of decay, just as the natural quick setting cements, and the artificial Portland cement, when well made, have done; and the attempts to discover the explanation of the different actions of these various materials, under the same circumstances, have led to the actual state of our scientific knowledge on the subject of the most advisable manner of using them.

Amongst the most important works in which the avowed object of the engineers employed was to obtain, by the use of concrete, solid blocks of large volume, which should resist displacement by their mere weight, may be cited the Mole of Algiers, originally described by M. Poiré in a "*Memoire sur les Travaux à la Mer*," published in Paris in 1841. In this case it appears that the quay walls, and certain parts of the Mole of Algiers, were formed by pouring concrete into caissons sunk in the positions selected, and lined with tarred cloth. This system M. Poiré states that he borrowed from the practice of the Italian engineers, who, when they have to repair a breach in a sea wall, cast down bags filled with concrete; and he adds that when the latter system is adopted, it is found that the small quantity of mortar which exudes from the bags binds the latter together in a very decided manner. But in addition to this use of concrete, M. Poiré employed it for the purpose of forming the jetty in deep water, by means of solid artificial blocks, cubing about 360 feet each, and weighing about 22 tons. These blocks were made upon land, and allowed to set in the atmosphere, the concrete being made by means of pug mills, and rammed into wooden moulds. The French engineers, it is important to observe, are very particular in causing the lime which they use in concrete to be made up into mortar before it is brought into contact with the ballast; they look upon concrete, in fact, as neither more nor less than a rough species of rubble masonry, in which the proper composition of the mortar is the principal element of success—a principle sorely neglected by too many of our *practical* men. At Algiers, the concretes thus made were composed of two parts of broken stone to one part of mortar, which yielded, in place, two parts of concrete. But when the concrete was at once immersed in the cases, the mortar was composed of one part of rich lime, slacked and measured in the pasty state, to two parts of puzzuolano in fine powder; when it was used for the preparation of the artificial blocks, the mortar was composed of one part of lime, as before, to one of sand and one of puzzuolano. It was remarked that the puzzuolano which succeeded the best was the Roman puzzuolano, and that its action depended upon its being used in the state of a fine powder; in large grains, or in grains of the size of coarse sea sand, it was inert. The lime was obtained from the grey primary limestones of the district, in the works at first executed at Algiers; but of late years the Theil limestone, obtained from the subcretaceous series, has been substituted for the indigenous material. In placing the mortar in the cases, the concrete was let down in boxes, the bottoms of which opened on hinges; in filling the moulds of the air dried blocks, great pains were taken to ram the concrete into all the corners, and to consolidate it as much as possible before the setting commenced. These works have, I may add, succeeded remarkably well.

Another very novel and important application of concrete for constructive purposes was the formation of the new Graving Dock, No. 3, at Toulon, under the orders of M. Noël. In this case an enclosure of close piling on the sides and the land end, but open towards the harbour, was driven. It was about 400 ft. long by 100 ft. wide in the clear, and the ground within this enclosure was dredged out to a depth of about 45 ft. below the mean level of the sea. A solid bed of concrete was then inserted, *under water*, of the total thickness, on the average, of nearly 15 ft. between this enclosure, which had been previously lined, so as to prevent the washing away of the lime, by means of sail cloth paid with tar. After the whole surface of the excavation had thus been levelled to the required height, three large caissons, in eight compartments of the form it was intended to give the concrete bearing

of the dock, were sunk in their definite positions and loaded with pig iron, &c. so as to compress the upper surface of concrete. Intervals of from 14 to 16 ft. wide were left between these great cases; and a space of 16 ft. 6 was left on each side between the sheet piling and the outer wall. The concrete of the side, head and gate walls, was then inserted under water as before; leaving, in fact, nothing but a lining of masonry and the steps, or altars of the Graving Dock itself, to be executed in ashlar masonry. The transverse spaces were filled-in with concrete, (which was afterwards removed) because it was feared that the infiltration would render necessary a great deal of pumping, and the engineer therefore thought it advisable to put in the bottom of the dock fractionally; but when a temporary earthen dam had been formed at the entrance, and the caissons were removed, it was found that the concrete had set so solidly that the anticipated danger from the infiltration proved to have been imaginary. Two small wells, indeed, (10 ft. long by 3 ft. 8 wide) suffice to receive the waters which come through the gates, those which fall as rain, or those which filter through the bottom. The quantity of concrete in the bottom was 554,336 cubic feet, and in the sides it was 418,612 cubic feet.

M. Noel has given a very able description of the work he thus so successfully executed, and of the mechanical contrivances he adopted, in the 25th vol. 2nd series of the *Annales des Ponts et Chaussées* for 1850; to which I must refer you for these all important practical details. It was indeed a marvellous work to insert a mass of concrete of these dimensions under so great a depth of sea-water; and its success must be attributed to the indomitable perseverance, and the ceaseless supervision of the engineer. M. Noel before commencing the immersion of the concrete, tried a series of experiments on the various limes and other materials at his disposal; and he finally resolved to employ in his concrete, a mixture of two parts of finely sifted Italian puzzuolano, and one part of rich lime measured in the slacked paste. These ingredients were mingled in pug mills; and subsequently mixed with broken stone, by being turned over with the shovel on a boarded floor, in the proportion of three parts of broken stone to two of mortar. M. Noel dwells a great deal on the precautions he adopted to get rid of the milk of lime which was forced out of the concrete when immersed; and perhaps the extent of this evil, as he describes it, may to some extent be explained by the great richness of the concrete he used. In the more recent works which M. Noel has executed, he has, I may observe, used the natural hydraulic limes of Thiel, with very small proportions of puzzuolano; and indeed in many cases he has abandoned the use of this latter material entirely.

More recently even than the execution of this wonderful work, an equally successful application of concrete blocks in marine constructions has been made by M. Pascal, at the new port of Marseilles. In this case a large portion of the roads on the west of la Joliette, and the old harbour, has been enclosed, and a remarkably well planned set of basins and docks formed, by means of a large jetty, or enclosure wall, the hearting of which is formed of stones thrown down and allowed to assume a natural slope; but the top of the slope towards the sea, just at the foundation of the upright parapet and quay wall, is protected by means of huge blocks of concrete thrown down from above. These blocks are, each of them, about 353 cubic feet in volume, and weight about 22 tons, a volume and weight found to be sufficient to resist the disturbing action of the waves of the Mediterranean in this position. The composition of the blocks is as follows: the mortar is composed of three parts of the Thiel lime, slacked by immersion, and measured in powder, to five parts of sand; or when it was necessary to obtain a more rapid setting, one-third of the sand was replaced by a similar quantity of puzzuolano: this mortar was subsequently mixed with broken stone, in the proportions of two parts of stone to one of mortar. The concrete was rammed into a mould, and allowed to harden in the open air for the space of three months before being immersed; when it was essential to immerse the concrete immediately, as in the case of the foundations of the quay walls, the proportion of mortar

was altered to two of mortar to three of stone. M. Pascal informed me that the artificial blocks had hitherto successfully resisted all causes of decay, and he most distinctly expressed his preference for good hydraulic lime over any mixtures of puzzuolano, or over any natural or artificial cements, provided sufficient time were allowed for its hardening.

Amongst the most important observations which have been made on the use of limes and cements in the Atlantic ports, may be cited those made at Fort Boyard, by M. Garnier, and especially those contained in a report by M. Feburier, inserted in the *Annales des Ponts et Chaussées* for June 1852, (3rd series, 2nd year, 3rd number) and in which he relates the experiments made by himself at St. Malo, upon several descriptions of limes, puzzuolanos (natural and artificial) and trass. Some very sad failures have, indeed, occurred at St. Malo in the recent concrete, or other masonry works there executed, in consequence of the action of the sea water upon them; so that M. Feburier's Report had a strong adventitious interest at the date of its publication. The result be arrived at does not however appear to me to be perfectly correct, nor does he seem to have taken a sufficiently comprehensive view of the subject. The substance of the report, and the principles M. Feburier has since acted upon are, indeed; 1st, that mortars composed of rich lime and Dutch trass, do not resist the action of sea-water: 2nd, that ordinary artificial hydraulic limes, or the natural feebly hydraulic limes, even when mixed with feebly hydraulic puzzuolano, equally do not resist: 3rd, that the only limes he distinctly states to be capable of resisting the said action of sea-water, are either the twice-burnt artificial hydraulic limes, or the natural hydraulic limes which approached the limits of the cements. M. Vicat has expressed a very unqualified approval of the principles thus enunciated; but really any person who has witnessed the extraordinary results obtained by the Dutch engineers in their hydraulic works, wherein they use almost exclusively mortars made of a mixture of the richest shell lime with trass and sand, must object to the absolute condemnation of such mixtures in the terms adopted by MM. Vicat and Feburier.

Towards the completion of the Breakwater at Cherbourg, some remarkable applications of cementitious materials were made under conditions which more nearly resembled those of ordinary English practice. The Breakwater itself is as you are no doubt aware, composed of a hearting of rubble-stone, à pierre perdue; upon the top of the mass a bed of concrete nearly 7 ft. thick, composed of hydraulic lime mortar and broken stone, was laid; the bottom being at the level of low-water of ordinary spring tides. Upon this bed, an upright wall of about 31 feet high towards the sea, and 30 feet wide at the platform level, was built of solid masonry, consisting of a course ashlar face of granite and large rubble hearting, set in hydraulic lime mortar when time could be allowed for its setting; or in cement (either Roman or Pouilly) when the masonry was likely to be covered rapidly by the tide. In many cases cement was mixed with the lime precisely in the manner of puzzuolano; and in the course of the work countless experiments were tried upon the values of all these materials. Latterly it was found to be advisable to protect the exposed base of the wall, seawards, by means of huge artificial blocks which should be able to resist, unmoved, the mighty waves of the Atlantic. These blocks were made just double the size of those used in the Mediterranean, or they were of about 720 cubic feet in volume, and weighed about 44 tons; yet one of them has been carried bodily a considerable distance. In building these blocks a mixed system was adopted: they were formed of rubble masonry, built up by hand on a platform on the riberme of the inner side of the breakwater, in a position wherein they were covered by each returning tide. The stone used was principally obtained from the schistous rock of the neighbourhood, and the mortar was either composed of Parker's or Medina cement and sand, or of Portland cement and sand, or of a mixture of Portland with one of the other cements. As a rule, M. Bonin, in his recent account of this gigantic undertaking, states that the engineers pre-

ferred the mixed cements; and that they only used the Parker's and Medina cements pure, when they required to guard against immediate immersion. The proportions adopted were $1\frac{1}{2}$ sand to 1 of cement (Parker's or Medina; or 2 sand to 1 cement Portland; or intermediate proportions when the mixed cements were used. M. Bonin observes that the Roman cements lose their power of rapid setting by being kept a long time in store, but that their ultimate resistance did not appear to be thereby affected; whilst, on the contrary, there was often danger in the use of Portland cement when it was too fresh. The engineers at Cherbourg appear to have given the preference to the built blocks of rubble masonry over concrete blocks, on the score of their obviating the necessity for wooden moulds; and the remarkable success of the system, notwithstanding the violent storms to which these blocks have been exposed since the first trials in 1846, has perfectly justified its adoption.

At Dover and at Alderney, Portland cement has been employed on a larger scale even than at Cherbourg, and the artificial blocks made at those two harbours are actually used instead of large blocks of ashlar. The jetties in these cases are formed of granite facings, filled in with blocks of concrete at Dover, or with very rudely built blocks of rubble masonry at Alderney. The concrete at Dover is made by mixing about one proportion of Portland cement to ten proportions of dry shingle, in a box which is maintained in a perpetual state of eccentric revolution so long as the materials are in the interior; and then the concrete is forced into moulds, where it remains from eight to ten days, in order to set, thoroughly: the blocks thus made are slacked for two or three months at least before being placed under water by the aid of the diving bell. At Alderney the concrete is made usually of one part cement, 2 parts of sand, and four of shingle, and into this material irregular masses of rubble, constituting about 40 per cent. of the block, are inserted. This appears to be a very strange complication of the Dover plan, and I confess that it is one I do not admire; because the use of moulds is compulsory in either case, and the insertion of the broken rubble by hand into the gangue of concrete cannot produce so homogeneous a mass as would be produced, if the concrete were made by one operation, and by the simultaneous mixture of the rubble itself, broken to the usual size of road metalling.

At Southampton Docks, and at Liverpool, the quay walls recently executed have been formed either by means of a rubble, or of a concrete backing, into the composition of which blue lias lime enters largely. Perhaps the Liverpool mortar-making machinery is the most perfect of any we have at work on our island, and the masonry executed with it is well worthy of examination. But, inasmuch as I have not been able to obtain particulars of it, I may be allowed merely to state that the various ingredients are mixed by edge runners revolving on fixed axes; but working in moveable troughs. The advantages of this system consists in the fact of its causing all the lime which may have passed through the screens after slacking to be equally hydrated, and at the same time; and thus it obviates both the irregularity in the setting, and the waste, which usually attends the use of blue lias lime.

In the execution of the Maidenhead Bridge, Mr. Brunel adopted a form and dimension of arch, which when the nature of the material employed is taken into account, must be considered to obtain its stability solely from the cohesion of the cement with which the bricks were set. The span of the arch was, in fact, 128 feet, and the radius of curvature at the crown was 169 feet; so that with ordinary bricks it was impossible that they should have at all acted as voussoirs. So closely indeed also did Mr. Brunel approach the actual limits of the resistance of the cement that the bridge was not completed without accident; and it must always be regarded as one of the hardest even of his experiments. Latterly in France engineers have trusted even more openly, and avowedly, to the adhesion of cements and concretes; and after some small bridges of concrete had been built upon a mould, as a test of this new style of monolithic construction, M. Gariel proceeded to construct, in a somewhat similar

manner, the arches of an aqueduct over the river Cousin (in the Yonne) of 103 feet span, 10 feet 4 rise, and 3 feet $3\frac{1}{2}$ deep at the crown, and of the Pont aux Doubles, Paris, also of the span of 103 feet, rise of 10 feet 4, and with a depth of 4 feet 4 at the crown. These were executed in ordinary rubble masonry set in cement, and were built in sections upon the centres, leaving intervals at the springings and on each side of the key section, which were subsequently filled in and wedged closely together; subsequently the Pont d'Alma, at Paris, of 141 feet span, 28 feet $2\frac{1}{2}$ rise, and 5 feet depth of crown, was executed in the same manner. The advantages of this application of cement are that they dispense with the necessity for the use of expensive ashlar voussoirs, and that they allow great economy in the construction of the centres. Moreover, as the vault can be commenced at several places at a time, the temporary load can be distributed more evenly than can possibly be the case with the voussoirs, working up regularly from the springing; thus not only is there an economy of time, but also the deformation of the centres is avoided. Advantage might be taken of the peculiar properties of the rapid setting cements to execute other forms of structures, such as domes, groined vaulting, &c. with considerable economy over the ordinary systems.

But perhaps the most interesting observations yet made on the class of materials under notice are those recorded by MM. Chatoney and Rivet in the *Annales des Mines* for 1856, in an article upon building materials used in sea water, of which I have published a translation in the *Journal of Gas Lighting*, &c. MM. Chatoney and Rivet do not indeed recommend any new processes, nor do they introduce any new materials; but they elucidate many obscure points in the philosophy of limes and cements which have hitherto escaped notice. Thus, for instance, they enunciate distinctly the principle that the formation of an artificial silicate of lime must be a slow process when effected in the humid way; and therefore it is that the system of allowing the various materials time to digest, as it were, a system which formerly prevailed here, and still prevails in Holland, is very correct. Mixtures of lime, trass, or puzzuolano, in fact require to be worked over frequently before being employed, care of course being taken to complete those operations before the crystallization begins. MM. Chatoney and Rivet with equal justice attributed the resistance of mortars to the action of sea water, to their compactness; and what is more doubtful, to the fact of their containing a proper proportion of free lime at the time of their application, which should form a coating of carbonate of lime able to protect the hydro-silicate of lime during its formation. I say this latter proposition is doubtful, because the experiments of Professor Way go to prove that the hardening of limes depends solely upon the manner in which the crystallization consequent upon the hydration takes place, and the eminent French engineers whom I have cited certainly have omitted to examine the effects of the excessive burning to which Portland cement is exposed, or the startling changes produced in plaster by a second calcination after having been slacked in saturated solutions of alum and borax. The degree of calcination affects this question to a far greater extent, I believe, than our French guides—for they are our guides in these matters—have yet admitted; and whilst I beg to be allowed to express my admiration for MM. Chatoney and Rivet's labours, I cannot but consider that much still remains to be solved in the mysterious theory of limes and cements.

I cannot conclude this very imperfect sketch of the recent applications of the class of materials under consideration, without recording as formal a protest as I can, against the ordinary mode of making concrete in this country. The system usually is to pour lime (in a ground state) out of a sack, upon a heap of ballast, without measuring either lime or ballast. The lime is slacked immediately upon the ballast, and turned over until the Irish labourers, who usually are charged with this work, are satisfied with its appearance. It is then put into a barrow, and shot into its place from a height. Anything more absurd than the whole of this system could not, I believe, be imagined. There is no

security for the perfect hydration of the lime, none for its equal and intimate mixture, none for the compactness or solidity of the mass. Without dwelling upon the abstruse chemical questions involved in the scientific part of the theory of limes and cements, I believe that I am justified in saying that good concrete can only be made by carefully slacking the lime as the first operation; by carefully mixing it with sand in proper proportions, so as to make a good mortar; by mixing this mortar with sharp angular ballast; and finally, by compressing the whole mass of the concrete so made by means of a careful ramming. We hear still of practical men, as they are called, and of professional men who ought to know better, attaching importance to the use of lime "hot," as they call it. Of course no one who knows anything of the real philosophy of the subject would listen to such nonsense; but the prejudice in its favour is still so strong, and I have lately encountered it in so many unexpected quarters, that I feel bound to remind the worthy partisans of the opinion I thus impugn, that the mere fact of the lime's being "hot" proves that it has not completed the whole of the process of hydration, and that, therefore, there is always a danger of a subsequent disturbance of the materials with which it is thus mixed. I believe that the mortars for concrete ought to be made with the same care as the mortars of the best brick work; for concrete is, indeed, but a rubble masonry of small materials. It would, I am also convinced, be preferable to make this mortar under edge rollers, and to mix it with the ballast in pug mills; and certain I am that the carelessness, if not the ignorance, of our practical builders in the use of limes, is one of the principal reasons for the excessive use of cements we witness in England, in positions wherein lime properly used would answer every reasonable purpose. It was principally with the hope of reviving interest in the enquiry into the right use of these materials, both limes and cements, that I have felt it desirable to bring before you the above brief notice of some of the proceedings and researches of our neighbours.

Mr. ASHPITEL, Fellow, said, with regard to the asserted hydration of lime, and the re-absorption of carbonic acid from the atmosphere forming another carbonate of calcium, that if such were the case, it would be necessary, in order to prove it, to experiment by synthesis as well as by analysis. In other words, if, when lime had been burnt, and then slacked or hydrated, it became carbonate of lime, they ought to be able to reverse the process so as to make it become chalk instead of mortar; and in fact to be able to burn it again and once more to make lime of it. This however could not be done, or only imperfectly. It was therefore clear to him that the whole theory of the chemistry of lime was not thoroughly understood. The reason the Romans had retained the art of making their splendid mortar was because they really could not do otherwise. The travertine and peperino they used were not limestones, their only limestone being the marble from the Apennines. They had no sand, the only substance like it being the natural puzzuolano, by the traditional use of which they made their extraordinary mortar, which indeed rendered their structures almost monolithic masses. It had been stated that this puzzuolano resisted the action of sea-water, which the artificial puzzuolano would not. The Mediæval architects in their concrete or rubble work, did not appear to have employed hydraulic lime. They took ordinary chalk and burnt it as well as they could, but the result was admirable. It was evident that they used it in a very fluid state; a fact shown in the large winding staircases at Rochester Castle. Structurally these were composed of nothing but concrete, and that it was used in a fluid state was shown by the manner in which it had passed between the crannies of the waling boards and through every knot hole; the solid mass, when set, carrying the stone stairs. The latter were in fact only added to give a better foothold. He had made numerous enquiries, but nothing like hydraulic lime appeared to have been used in the middle ages. Sir C. Wren had given

great attention to hydraulic limes used on land, but Smeston was the first to give any serious notice to those used in water work. Scientific men had now arrived at this point:—they could make artificially hydraulic lime; as Portland cement, a most admirable material. Many years ago his father and himself had tried experiments with common clay and chalk, and found they could make very good hydraulic cements; but however successfully these resisted the action of fresh water, subsequent experience showed they would not resist sea water, and for this there must of course be some reason. It had not escaped the observation of Mr. Burnell, that the compositions usually called concrete in this country were much too hastily got up. They should rather be put together in the way called by their French neighbours "*béton*," and should have time to become thoroughly hydrated. But there was another fact; with fat or rich limes and trass the English architects did not succeed in making that sort of hydraulic composition which the Dutch made in former times, and (as Mr. Burnell stated) at present. There must, therefore, be a *tertium quid*, or something which in this country was not understood. That was manipulation—an important thing, for the fatter the lime the more time it should have to become hydrated. Returning to the theory of hydraulic lime and its resistance to sea water, he had often thought it probable that puzzuolano possessed one condition wanting in the substances generally mixed to make hydraulic limes, because puzzuolano contained much oxide of iron. He had learned, with much surprise, from Messrs. Grissell, who had been building some very large bridges in Essex, that on taking up the concrete of some structures which had been removed, they perceived that the most durable portions, which had best resisted the action of sea water, had portions of iron in contact with them, and that they had consequently adopted the plan of throwing scrap iron into their concrete, and in one instance a piece of hoop iron; and the result was that their concrete became, he might say, *iron bound*. Masses of shingle were frequently found on the chalky sea coast with an appearance of red rust, hanging together so firmly that neither hammer nor pickaxe could separate them. Now the peculiar colour showed that there was a great deal of iron in them; the same was the case in puzzuolano. He had not tried Messrs. Grissell's plan himself, but if his information was correct, and if the theory he founded upon it was right, it afforded a very short and simple method of improving the manufacture of concrete for marine constructions. He could not conclude without expressing his deep regret that his friend the late Commendatore Canina had been prevented, by his untimely death, from carrying out the experiments he had intended to make on all kinds of hydraulic limes, and to compare them with specimens from the remains of Ostia and the aqueducts at Rome. Messrs. White had sent specimens of Portland and other cements to Rome, for the purpose of these experiments, but they remained still unpacked, and nothing was likely to be done. Had Canina's life been spared, he (Mr. Ashpitel) might have been able to lay the results before the Institute.

Mr. BURNELL begged to explain that he did not mean to imply that manipulation constituted the sole difference between the Dutch and the English concrete. The effect of puzzuolano and trass depended upon the action of the silicate of alumina which they contained upon the lime. This action was very slow when it took place in the humid way, and it was therefore necessary that the lime should be turned over frequently, thus rendering a large amount of labour requisite. The high price of labour in England made it almost impossible to afford so much manipulation in turning over the lime and concrete as was used by foreigners, and no doubt that was one reason why we were driven to the use of the quick setting cements. With regard to the presence of oxide of iron, it was no doubt a very valuable material for hardening concrete, but it was an exceedingly expensive one. He understood that iron filings had been mixed with the concrete for the Victoria Tower, and no doubt it had answered; but a proper proportion of Portland cement concrete would have produced a better result for less money; and, after all, these things were questions of money.

The Chairman, Mr. J. J. SCOLES, V.P. said, that Portland cement was not known when the foundations were laid for the Victoria tower.

Mr. BURNELL observed that at all events blue lias lime was known, and, if properly used, it would have made a concrete quite equal to that actually used.

The CHAIRMAN said that blue lias lime was not used in London, or was not in the market at the time referred to.

Mr. BURNELL said it had been recommended by Smeaton many years before.

Mr. WOODTHORPE, Fellow, proposed a vote of thanks to Mr. Burnell. The meeting would all agree with that gentleman in his remarks on the inferiority of concrete as generally used. The rage for cheapness, and the modern system of "cutting," would not enable the architect to spare a sufficient quantity of labour on the foundations of his structure. Mr. Burnell's paper would enable them to store up some valuable information, and they might impress upon employers that a little more money ought to be spent under the earth than at present.

Mr. KERR, Fellow, seconded the motion. Mr. Burnell had not alluded to that species of hydraulic lime which was formed by the mixture of blue lias lime and "smiths' ashes," a metallic sand; the mixture being one of the hardest that was known. Smiths' ashes would have produced the same result as iron filings in the concrete for the Victoria tower. Although they might not understand the chemical theory of limes, they ought to understand the mechanical question of mortar; but this unfortunately was not always properly considered. They all acknowledged the theoretical point that the smaller the quantity of good lime, and the larger the quantity of sand, the better would be the mortar; the reason being that the strength of the mortar did not lie in the lime, but in the sand; the smallest quantity of lime acting as a cementitious material between the grains of the sand being theoretically the perfection of mortar. What Mr. Burnell had said was therefore very true and important, as a large quantity of lime intervening between masses of stone in badly mixed concrete formed a very different cement indeed to good mortar. The interstices of the stone should, in the first place, be filled with sand, and then the particles of sand filled with the lime.

Mr. ASHPITEL referred to the roof of the Pantheon at Rome, mentioned by Mr. Burnell. This he believed was not entirely of concrete, but was formed of ribs of brickwork, with arches at the top and bottom, between which the concrete was filled in. It had stood remarkably well. The dome had been originally covered with tiles of bronze, which however had been taken off.

Mr. T. H. LEWIS, Fellow, said that the skeleton of the dome was formed of ribs, in the manner of an iron dome, and the spaces between the ribs and the arches were filled in with rubble work or concrete.

Mr. C. FOWLER, Associate, stated that he had seen the concrete put in for the foundations of the Victoria Tower, and to the best of his recollection smiths' ashes, and not iron filings, was the material employed to add to its solidity. The concrete was prepared with a degree of care which he had never before witnessed, and as a young student at the time, he had been very much struck with it. In reply to the Chairman, Mr. Fowler added that the lime and sand were not mixed as mortar before being combined with the ballast. Indeed he had never seen or heard of that plan being adopted in England.

The CHAIRMAN said that the late Mr. Savage, in his advice and specifications, always recommended the mixture of the lime and sand before the pebbles were added. Notwithstanding however the somewhat slovenly plan generally adopted, our concrete appeared to set in a short time, and stood very well.

Mr. BURNELL observed that it would do so when confined within the earth, and that lime in the very worst concrete would slack and form a solid mass in damp ground; but the great test was exposure to constantly changing sea-water.

The CHAIRMAN referred to the sea wall at Brighton, which was exposed to the action of the waves.

Mr. BURNELL said that in that case, he believed the lime and sand had been mixed first, and the shingle added afterwards. The great difficulty arose in such works as that at Toulon, where a thickness of 15 feet of concrete had to be thrown through a depth of 45 feet of water. Minion, or the scales from roasted iron ore, had been recommended by Smeaton for mixing with blue lias lime; and these scales were much the same as smiths' ashes. The Belgian engineers employed the ashes falling through the grates of the lime kilns, which carried down with them a portion of the coal and the lime, and made a very good hydraulic cement for earth work.

The CHAIRMAN referred to a sea wall on the coast of Norfolk below low water mark and exposed to the waves, in which a very good hydraulic cement had been made from Dorking lime mixed with the sand of the beach.

Mr. BURNELL said that Dorking lime was made from the lowest beds of the chalk, which were highly charged with soluble silica, and amongst which Professor Way had found some of the most remarkable of the beds on which he had been experimenting. He was therefore quite prepared to bear that, if those beds were properly selected, one of the most magnificent hydraulic cements which it was possible to use might be obtained; indeed he might say that it was in this source they ought to seek for a natural puzzuolano.

Mr. G. F. WHITE, Visitor, believed that smiths' ashes would only form a mechanical mixture with the lime, whereas a small quantity of iron (from 2 to 3 per cent.) was found in chemical combination with all natural cement stones. The difference was analogous to that which existed in the manufacture of cement by steeping the sulphate of lime in a mixture of alum or borax, which produced a different effect to that which would be obtained by mixing it with the sand or the cement while it was being gauged. He doubted very much whether the hardness of cement was aided by, or whether any value was to be attributed to, the presence of iron beyond a certain point. He believed the combination of the alumina with the lime in certain proportions, and their proper combination to the degree of baking, were of great importance. After all the great point was the way in which the cements were manipulated. At Dover the concrete was formerly made by hand, and with all the "elbow grease" that could be given to it the result was a very imperfect combination. By the present plan a drum placed at an angle of 45° was made to revolve on its own axis, and by a concentric motion the contents of the top of the drum were constantly cast to the bottom of it. The mixture thus produced was perfect. He was himself concerned with the manufacture of the material and not with its use; but he must compliment the English architects and engineers on their economical use of materials as compared with the French. At Dover the blocks of concrete which had been described were produced at a cost of 7d. or 8d. per foot cube, all expenses included; whereas at Cherbourg, where he did not think they had a more solid combination, or more salt water or wave resisting power than at Dover, the expense incurred by the way the materials were combined was 16d. per foot. In fact the cement alone cost the same as the labour, cement, and other materials and expenses at Dover. He thought this an important feature to be borne in mind.

Mr. NEWTON, Associate, referred to a large block of natural concrete which he had seen at Dover some years ago, and to the desirability of carefully considering the conditions under which these blocks were formed on the chalk cliffs washed by the sea, and how far exposure to the sun and the lapse of time affected their solidity.

Mr. L'ANSON, Fellow, referred to a case in which wood ashes had been mixed with lime and used

in concrete in the same way as smiths' ashes. It was the pavement of a forecourt which had been subject to continual wear and exposure to the weather for many years.

Mr. BURNELL believed that this tended to bear out his remarks on the effect of soda or common salt, which were in some respects analogous to wood ashes or potash. Some effect, which could not be at present explained, was undoubtedly produced by these materials in the hydration of lime. He should be very unwilling however to subject such concrete to exposure to sea water.

Mr. M. D. WYATT, Hon. Sec., proposed a vote of thanks to Mr. Sidney Smirke for his communication on the subject of Water Supply. He wished that some gentleman practically acquainted with the pottery trade had been present to favour the meeting with information respecting Mr. Smirke's suggestion. He thought they must feel, when they considered the vast improvement which had of late years been made in drain pipes, and other articles of large size, that sufficient progress had been made to render it easy to carry out Mr. Smirke's suggestion, unless practical men could point out any difficulty. It would certainly be desirable to get rid of the article "cisterns" in the plumber's bill.

The CHAIRMAN said that wooden cisterns lined with zinc were very good; they were cheaper than lead, and less liable to be stolen, whilst they did not injure the quality of the water.

Mr. L'ANSON said he had seen cylindrical zinc cisterns of large size without wooden cases, and also large cisterns of wrought iron galvanized. The latter were lighter than either slate or lead. He feared that cisterns of pottery would be liable to fracture if exposed to frost.

Mr. ASHPITEL said he had visited Staffordshire in reference to the fittings for some baths and wash-houses, and found on enquiry that the ordinary bath was about the limit of the potter's art in point of size, and even these were necessarily high in price, as they broke two out of three in the making. Cisterns of earthenware would be too heavy, and very subject to injury from change of temperature, as baths were often fractured by the sudden admission of hot water. He was afraid the suggestion of Mr. S. Smirke could not be practically carried out. The cheapest thing of the kind was a number of large drain pipes built up one upon the other, but these were also open to the same objection.

Mr. BURNELL said that the real question was, the best plan of supplying a certain quantity of water cheaply to the poor, and he was disposed to believe that the most sensible system was that of the constant supply, so as to do away with cisterns altogether. It was, however, important in that case to prevent waste of water, which was carried on now to such an extent as would prevent any Corporation or Water Company supplying it so cheaply as it should be supplied. He felt convinced that it would ultimately be necessary to let the supply pass through meters, and sell it by measure.

Mr. ASHPITEL seconded the vote of thanks to Mr. Smirke, which was carried unanimously, and the meeting adjourned.

REMARKS ON BYZANTINE CHURCHES.

By the Rev. J. L. PETIT, M.A. Hon. Member.

Read at the Ordinary General Meeting of the Royal Institute of British Architects,
March 8th, 1858.

I AM quite aware that the subject of Byzantine architecture, on which I am going to read you a paper, is one about which the majority of my audience probably know more than myself. For till last year, I had seen nothing Byzantine, except, as one may say by reflection; and at the present time I have seen no more than such specimens as came in my way during a somewhat hasty trip to Athens and Constantinople. Still I shall address you with confidence, as the fresh impressions of a traveller, however imperfect or incorrect, are often suggestive; and I am sure that any of my remarks which may be calculated to mislead, will be speedily corrected; and should anything I say be thought worthy of discussion, I shall gain much more information than I ~~can~~ I am likely to give. Without raising the question as to what buildings are properly to be called Byzantine, and what Romanesque, if there be any marked distinction of style between them, I will begin by remarking that it is not now my intention to notice any that are altogether borrowed from Roman work; as churches of the basilican form, or those which may be classed under the head of circular churches, such as S. Costanza near Rome, S. Vitalis at Ravenna, and Little S. Sophia in Constantinople. Their introduction at present would take time, and confuse the subject.

I look upon the Byzantine style as peculiarly interesting; for it appears to have been the first really original development of Christian architecture, and to have held its ground, with little essential change, through a very long period, over a large tract of country; it has moreover furnished types to which we are indebted for some of the finest buildings in existence. The arch and the dome, we know, were both used by the Romans. But the pendentive which connects them, itself as refined an invention as either, did not make its appearance, as far as I am able to learn, till it was applied by the Byzantine architects to their domical structures. I mean that kind of pendentive which is formed by the section of a larger dome than that which it sustains. The vertical support of the arch on which it rests, or the wall to which it is attached, and certain abutments by which its lateral pressures are counteracted, not only preserve it in equilibrium, but enable it to bear the weight placed upon it, just as a dome open at the top, is made to bear a lantern. I observe that Mr. Fergusson, in his chapter on Sassanian architecture, gives a building of very early date in which a dome is supported by arches. But in this example the Romanesque pendentive is used; an arch, or series of receding arches, being thrown across each angle of the square; a construction better adapted to a polygonal, than a cylindrical or hemispherical superstructure. If this was the universal mode of construction employed by the Sassanians, it does not invalidate the claim of the Byzantines to their own peculiar pendentive, however it might have led them towards its invention.

I have spoken of certain abutments as necessary to counteract lateral pressure. Such as are required in the vertical plane of the arch itself are supplied by its own masonry or that resting on it. But there are clearly other pressures which act at right angles to this plane, and have a tendency to push the arch outwards. It must be a most difficult problem to calculate these mathematically, even on the simplest basis; perhaps it can only be done by experiment. In small buildings, I suppose,

they need not be taken into account; the weight or thickness of the wall, or the cohesion of the materials will be found sufficient; but in domes of a considerable span some sort of abutment must be necessary at every point of the arch in a direction at right angles to its plane. This is best furnished by a barrel vault, or else the semidomical roof of an apse. On this account, I conceive the Byzantine style is not calculated to develop itself in the direction of Gothic, the essence of whose construction is the concentration of pressure upon single points, and the separate independence of each bay of vaulting, above the spring of the arches; the avoidance in fact of any action upon a principal arch, in any direction except in its own plane. I merely advert to this point, the full consideration of which would occupy a great deal of time. We may observe that the Byzantine pendentive is used only at rare intervals on our own side of the Alps, except in districts where an eastern influence was clearly at work, as in Aquitaine; nor does it seem to be of frequent occurrence in Italy. Even at Palermo the two buildings which exhibit the most decidedly Greek character, namely the Ercmitani and the Martorana, have the Romanesque pendentive; the Byzantine, however, is used in S. Costanza, in the island of Capri, in the Bay of Naples.

The baths of Diocletian, have in fact, a more direct tendency towards Gothic, than any of the Byzantine churches in the East, or those in the West which are derived from them (as the cathedrals of Perigueux and Angouleme), notwithstanding their adoption of the pointed arch. But though not Gothic in its principle, the Byzantine construction is perfectly scientific and artistical; and accordingly we find that it was gladly accepted by the revivers of the Italian style, and continued to prevail in the East, when the Greek church was superseded by the Saracenic mosque. We know, from Procopius, that S. Sophia, in all essential points, was originally what it is now; that it had its central dome supported by four arches. Nor do I suppose it has ever been doubted that the present pendentives are either the original ones themselves, or, at least, of the same form and description. Now it is not at all likely that a novel construction of such delicacy was attempted for the first time on so enormous a scale. It is far more probable that Justinian and his architects found the same mode of building to be in common use, perhaps in the very churches which they pulled down and replaced with others of greater magnificence. I do not know whether there are churches of the sort whose date is ascertained to be earlier than the time of Justinian, that is, the sixth century; but I should think it possible that such exist in many parts of the East. If the small number of Greek churches with which I am acquainted at all fairly represents their general character, I am inclined to look at S. Sophia in many respects as an exceptional building rather than a typical one. We will consider its plan, simplified by clearing it of the aisles and galleries which lie beyond its principal area; its horizontal section in short taken through the springs of its main arches. I have made use of the plan in Mr. Fergusson's hand-book, as that gives me the section I want more clearly than any other that I know of. This plan both shows the general construction, and expresses the leading lines on which the internal effect depends. It consists of a square compartment, having to the east and west semicircular apses of its full width. From the eastern apse branch out three smaller ones separated from each other only by the necessary piers, and with them occupying the whole of the semicircle. From the western apse branch out in like manner, two others, with a passage between them leading to the outer parts of the building. The north and south sides have no transepts or projections (you will remember I am speaking of the upper part of the building), but present flat walls, pierced with windows, and arches supported by columns. Now, unless I am mistaken, the radiating apses, which we have noticed, are by no means common in Greek churches. I will not say they never occur; Lenoir's plan of the Church of the Apostles, in Athens, give something of the sort. I am sorry I did not see its interior, but I dare say I shall be excused for not giving my undivided attention to Byzantine churches while I

was in Athens. In most cases the Byzantine apses seem to be parallel. We are well acquainted with the radiated apse as belonging to a large district in the south of France, Auvergne being its head quarters. Occasional instances of it occur beyond this district, and even in England, but rarely on the Italian side of the Alps. And if we take a tract of country comprising Italy, Greece, and much of the East, I suspect we may fairly pronounce this arrangement of the apses of S. Sophia to be somewhat abnormal. And the want of transepts is unquestionably so. According to mathematical strictness, as we have observed, the construction requires transepts; and I have very little doubt their want was felt in this instance. The depth of the huge buttresses to the north and south tells us that transept walls were wanted, and their immoderate thickness gives us a hint that the abutment which should have been supplied by a roof was missed in no small degree. In the neighbouring church of S. Irene, destroyed by fire in the reign of Justinian, rebuilt by him, and afterwards much repaired in consequence of injuries from an earthquake in the eighth century, the transepts are perfectly well developed, although, as in most Greek churches, their fronts, in the lower part of the building, do not project beyond its outermost wall. I conceive we must attribute the peculiarities of the plan of S. Sophia to a certain timidity on the part of the architects, who were frightened at the boldness of their own design. And this timidity, as is generally the case, led them into danger. It is probable that no arches then existed of a span equal to that which they were contemplating; a span scarcely differing from the diameter of the dome, that is, upwards of 100 feet. I am not aware that any other such arches now exist; their springs you will observe are at a height of near 80 feet from the surface of the ground. Of course I do not speak of bridges, which have a solid abutment of rock. The arches in Diocletian's baths, and in the Temple of Peace, do not, if I recollect, exceed 80 feet. And those under the dome of S. Peter's are not more than 90 feet, though the diameter of the dome itself is considerably greater than that of S. Sophia. Now we may well imagine that Anthemius and Isidorus, when they came to put their ideas into brick and stone, felt that they would rather have only two such arches to deal with, instead of four; and their first expedient would be to turn two of them into blank arches, and fill them up with walls, which might save them from the necessity of providing any extraordinary abutments to the east and west. Still they had to provide abutments to the north and south, and must have done so to good purpose, for according to the story handed down to us, these buttresses were strong enough to bear a great and sudden thrust. I do not know to what stage of the work the anecdote I allude to refers; most probably to the completion of the arches themselves, before the pendentives and dome were added. You will correct me if I give a wrong version of the story.* The architects ran in a great fright to the Emperor, and told him that the great eastern arch, then resting

* Since the above account was read by me at the Ordinary General Meeting I find that in retelling Procopius's anecdote about the arches of S. Sophia, I had misunderstood both the Greek of the original, and the Latin translation. The true version of the story is this. That while the eastern arch was yet incomplete at its crown, the weight of what was already finished, at each end, appeared to be too much for the temporary supports, which began to crack in every direction, and threaten instant ruin. Justinian's advice was not, as I supposed, to take away the supports, but to complete the arch, for, said he, it will then sustain itself without the aid of the framework beneath. As I admit the error, there is no occasion for me to explain how I fell into it; but I would remark that the version I gave of the story seems to involve no absurdity, if the sequel of it, respecting the other arches, is to be relied upon. The arches to the north and south were raised upon walls, which acted the part of centreing, and, like the actual centreing of the eastern arch, showed symptoms of being distressed by the weight above. In this case, the arches seem to have been complete, but they had not been allowed to settle, and therefore the emperor ordered the architects to remove those parts of the masonry beneath, which came in contact with the arches, and not replace them till the mass above had settled, and become perfectly dry and solid. The first fright of the architects arose from the effects of an unfinished arch, the second, from those of an unsettled arch. The apparent danger was pretty much the same in both cases, but the causes, and consequently the modes of cure, were different. The passage is quoted in Vernet's *"Architecture Byzantine en France."* J. L. PETIT.

on its centreing, was swaying about in a most alarming manner, threatening to destroy its supports, and throw the whole fabric into ruins. The Emperor, it was supposed under some divine inspiration, for he did not pretend to any mechanical skill, ordered them immediately to knock away the props from under the arch, telling them it would settle down of itself to its proper shape, and then remain quiet. The operation was performed with success. Soon afterwards the two arches which were supported by actual masonry began to play the same tricks, and cracked the walls and columns below in every direction. The architects again ran to their employer, who prescribed the very same remedy; ordering them to knock away the stone centreing, the wall which filled up the arch, wherever it came in contact with its inner surface; and not to fill up the void, till the arch had thoroughly settled. Consequently the abutments provided by the plan of the building to the east and west, though it was at first intended they should have no pressure at all to sustain, proved in fact, amply sufficient for the thrust of the entire arch.

With regard to the radiating apse, I imagine it to have been suggested by the demand for a buttress in the direction of a transept. Its wall, you see, forms a kind of diagonal buttress, which a small addition of solid work might render sufficient for its purpose. But whatever may have been the motive of the architects, these radiating apses give additional extent, both in reality and appearance to the area, and much beauty and variety to the views of the interior. I do not know another building in which the impression of great uninterrupted space is so marvellously conveyed. And if we take a utilitarian point of view, the plan is certainly worth consideration in the present day. Had the central part, now covered with a dome, been vaulted instead, no blame could have been thrown on the constructive design, though undoubtedly the effect would have been far less imposing. In that case the whole lateral thrust of the roof would have been concentrated at the four angles of the square, which are the points of support. In the present case, a great part of the thrust is so concentrated, but not all. Some, as we have remarked, must have acted upon the arches during their whole length, and though in small buildings the amount of this portion of the thrust is immaterial; in one of so large an extent it could not but have been felt, and perhaps was the cause of some disasters subsequent to the first erection of the building.

The usual types of Greek churches combine great strength with elegance. I have remarked three principal ones. The first I can best explain from a plan and sketches of a small church near a monastery at the foot of Mount Pentelicus.

If we take away the narthex, or western porch, and a small eastern apse, the plan is externally almost square, and internally cruciform. The arms of the cross are very short, being little more than deep arches or recesses. At their intersection is a dome or lantern, the inside of which is circular in its plan, but the outside octagonal. At the angles of the square are solid masses of masonry, which form the abutments of the arches. These only occupy the lower part of the building; the cruciform composition developing itself above, in the external as well as the internal view, an arrangement generally adopted in Greek churches. The later mosques frequently carry up the square unbroken, the dome rising from within. In the example before us, the apse is internally semicircular, externally angular, the diagonal sides springing directly from the eastern wall. This is also a common Byzantine feature. To the same type I should refer those churches in which the piers of the principal arches are heavy and solid masses of masonry, even if they do not fill up the area between the elegant inner cruciform plan and the outer square plan, but allow passages or aisles. In this case the transept becomes longer, and the principal eastern apse is often flanked by two smaller ones. As this type of Byzantine church is the simplest, I am inclined to look upon it as the oldest, though churches of a later date may be found belonging to it; for instance, the elegant church of S. Theodore in Athens, which, I believe, is assigned to the end of the twelfth or beginning of the thirteenth century. S. Irene,

in Constantinople, of which we have already spoken, may be referred to this type; from which, also, are derived the domical churches of Aquitaine.

The next, in point of simplicity, probably also of date, is the one to which I specially wish to direct your attention. In this, the square area at each angle of the plan (still externally square), and which we have hitherto seen filled up with solid masonry, or else shut out by a large and massive pier from the rest of the church, is thrown open to it, having only at the angle which corresponds with the springs of the principal arches, a comparatively slender column, connected with the adjacent walls by arches of smaller height and span. The main arches do not spring from the capitals of these columns, but from a point on a higher level than the crowns of the small arches, which may be considered as forming, together with their column, a kind of square open pier, attached to the walls, on the top of which pier rest the barrel vaults connected with the central dome. The spring of the vaults is occasionally marked by a string or cornice, but not always. Sometimes all the angles are treated in this manner; sometimes only those to the westward, the eastern ones retaining the solid pier. Of this latter description is a church in Corfu, to which I had time to give some attention. Its dedication, I understood, was to SS. Jason and Sopater, who were supposed to have built it, or a church on the same spot—we will therefore call it S. Jason. It struck me as having a remarkably good outline, from whatever point I viewed it; and the inside, though very plain, and a little bit modernised, was not without considerable dignity. The plan and sketches will show you its general character. The columns belonging to the western piers of the dome are of marble, and probably antique. Their diameter, near the base, is about 1 ft. 10 in., and the height of the shaft 10 ft. 2 in. The distance between them is about 15 ft. Their capitals are rather clumsy, being spread out into a wide abacus, on account of the mass they have to sustain; but, in some examples, this part of the design is treated with great elegance. The narthex is in three divisions; the central one nearly of the same height as the nave, and separated from it by a screen of three arches on two slender marble columns. This compartment has a barrel roof running in the same direction with that of the nave; the lateral compartments are lower, and have barrel vaults which run north and south. All the arches are round. The dome (as usual) has a drum, internally round, externally octagonal; its square base shows itself above the outer roof; this also is usual. The pendentives are of the Byzantine form, and on them are sculptured extremely rude symbols of the Evangelists; whether these are marks of antiquity, or freaks of the modernising Venetian, I cannot tell. The apses are all semi-circular in the inside, but the outside of the principal one is angular. In my plan I have drawn lines showing the direction of the axis in each of the barrel vaults; from which you will perceive that the outer wall receives an extra thickness where it is required to act as an abutment. And I may also notice that the marble columns do not perhaps really bear the full weight they appear to bear; for, as the masonry settles down, a sort of arch or buttress may be considered as being virtually formed, passing through the crown of the principal arch to the outer wall, or some other strong mass of masonry, and sustaining much of the superincumbent weight. If the form of these churches were adopted as a model, such relieving arches might be built in the walls, as they doubtless often are under similar circumstances.

Had I been able to decypher certain Greek inscriptions on marble slabs, I might possibly have found some clue to the date of this church, as well of another little church situated upon *Πορσκουρις*, which signifies Mouse Island. In this latter, the most decidedly Byzantine bit, the east window is, to say the least, equivocal; and yet I hardly think it can have been the work of the Venetians. The span of the arches under the dome is about six feet and a half, so you may suppose it is not a very large edifice. I have attempted to give a general view of it, as well as a trollys of

vines which hid nearly the whole, would allow. The island is one of those seen from the one-gun battery, a spot visited for the sake of the view, by every one who touches at Corfu.

Of the Byzantine churches in Athens given by Couchaud, some have disappeared, and been replaced by larger structures. Among these is S. Taviarchus. Such as remain, have been enough restored to make us hope that their preservation is intended. The old Cathedral will, I trust, be allowed to rest in security under the protection of the new one. This latter, by the way, is a building of which the modern Athenians will have no reason to be ashamed, though its general proportions might have been better. It recognises the Byzantine style, but by no means copies it slavishly. I wish the photograph I bought had taken in the doors, which I admired very much; the windows are far inferior in design. But to return to the old Cathedral. The dome rests, in the manner I have already shown, on four very slender piers, which, I suspect, have been substituted for antique columns. The principal apse alone appears externally, those on each side of it being sunk in the thickness of the wall. The walls are faced externally, if not built, with blocks of sculptured marble, and the doorways display a classical elegance. This little building has been supposed to be of very high antiquity. But I was told by a gentleman residing in Athens, that he had heard its claims disputed; and I must say it appears to me, on strong grounds. For while some of the sculpture on the outside is classical, (you will observe especially a frieze or range of small figures under the cornice), a great deal of it is decidedly Byzantine, and as decidedly not *in situ*. The attention to symmetry and regularity is just what would be shown by a person who had to deal with a number of promiscuous specimens that happened to come to his hand. Much more regularity of pattern would have been obtained by an architect or sculptor designing a front in new material. There is no want of symmetry in Byzantine architecture; on the contrary, it is rather carefully observed; nor was it likely to be neglected in the arrangement of sculpture, when designed with a view to the spot it was to occupy. By symmetry, I mean a harmonious correspondence, not an exact repetition of pattern. The use of old classical materials does not make against the antiquity of the specimen in question, but the use of Byzantine materials does very decidedly.

The church of S. Saviour, situated at the foot of the rock of the Acropolis, and partly cut out of it, has four marble columns, of classical proportions, and apparently antique, in the positions already indicated. The church is very small, and has no narthex; but, besides the picturesqueness of its position, I was much struck with the beauty of its outline. It is figured in Lenoir's work. According to Couchaud's plan, the church *ἑστὶν ἀνὰ τοὺς ποταμούς* (of bodiless spirits or angels) near the Temple of Theseus, has also the four columns. I did not go into it, as it seemed much modernised.

Another church of the same dedication, near the hill of *Ἀντιστύρις*, has also four marble columns. The narthex has a dome over its central compartment, which appears externally in the form of a second octagonal lantern, smaller than the principal one. A modern western porch has a dome which does not appear on the outside. This repetition of the principal dome in another part of the building seems to have been common at an early period. We notice it in S. Irene, Constantinople; and Procopius mentions one of Justinian's churches, which, in the number and position of its domes, must have been something like that magnificent example of a later period, S. Mark's at Venice.

The church of Kapnicaréa has, if I recollect, four columns of classical proportions. To the north of the central dome is one of less elevation, the arches of which rest on solid piers. The narthex presents, on its western front, a series of four gables, and is entered through a very elegant porch on the south side. M. Couchaud spoke of this church as likely to be pulled down to make way for a street. But as his work bears the date 1842, I trust the danger has passed away. A sort of square

is being formed, of which this beautiful object will occupy the centre. The Greeks seem now to prize their monuments, and are disposed to preserve them where it is possible.

The church of S. John the Divine, near the Acropolis, has two columns; the eastern arch resting on piers connected with the east end. The masonry of these churches consists mostly of squared blocks of stone, their courses being separated by thin bricks or tiles, which also occur in the vertical joints. The arches are generally turned with brick, and the strings are enriched with bricks projecting diagonally, and forming a serrated edge, just as in brick-work of the present day. You will probably have noticed the peculiar composition of most of these Athenian domes. The drum is externally octagonal, each face being finished at the top in a semicircular arch, resting on the rough shafts and capitals which occupy the angles. Within this arch is the window, sometimes a double one; and above is the dome, covered with tiles. Now, whether you admire or condemn this kind of finish, you cannot pronounce it altogether fanciful. For, supposing a hemispherical dome to stand on a cylindrical drum, if you change the latter into an octagonal one by cutting it with vertical planes, the above form will be the result; and the faces will show the position of arches, which, when pierced through to the cylindrical and spherical inner surface, need present no double curvature. I visited a small ruined monastery upon Mount Hymettus, which has a church on the same type, having four columns. But I mention this especially, to show that the construction cannot be of a weak or perishable nature; for although the monastic buildings are altogether in ruins, the church, of which the outer roofs present the appearance of heaps of loose tiles and rubbish, is yet in perfect preservation; and, what makes it the more remarkable, the columns, though very slender, are not monolithic (as they are in almost every instance), but composed of several pieces. I have no doubt very little of the weight of the dome actually presses on them.

The third Byzantine type, probably the latest of the three, is that which we find at Daphni, a few miles from Athens, on the road to Eleusis. I was very glad to find it there, for otherwise I must have sketched S. Nicodemus, which is almost wholly rebuilt, and though I believe very correct, is terribly unpicturesque. However, I picked up a photograph of it. I have been obliged to resort to Couchaud's work to help me out in my plan of Daphni, as I took my notes very hastily, and did not see the side chapels. The characteristic part of the arrangement is, that each side of the square circumscribing the dome has three arches instead of one, the central being the largest, consequently the dome occupies a portion of the building analogous to that covered by the dome of S. Paul's, or the lantern of Ely; namely, a space equal in width to the nave and both its aisles. Across the angles of this square are thrown arches with conchas. And, observe, they are provided with a truer abutment than most Romanesque pendentives in the western churches; for as their spring is placed over a pier, they have the advantage of whatever may be on the other side of the pier; whether a continued wall, or an arch. The octagon, supported by these conchas, is connected with the circular drum and dome by small pendentives. The drum externally has sixteen sides; at each angle is an engaged shaft of small projection. The diameter of the dome is not more than 24 feet; yet the whole building, which is beautifully situated, has rather an imposing aspect. Towards the west end is some work of a Gothic period. This type is partly followed, in a columnar form, in the church of S. Fosca at Torcello, near Venice. The tower of S. Antonio, at Piacenza, of which a section is given by Mr. Ferguson, is supported according to the same mode of arrangement; as is also Bramante's dome of S. Maria delle Grazie (in the cinque cento style) at Milan. And the plan is suggestive of that of S. Stephen, Walbrook, the outside of which is perfectly Byzantine in its composition.

It is not quite so easy to study Byzantine churches in Constantinople as in Athens. In the first place, they are mostly changed into mosques, and are not readily opened to the profane. In the next place,

their Christian names do not seem to be very well known. I had seen in Mr. Fergusson's book, that one of the best specimens was the Theotocos; so I asked my guide (a Greek) if he knew it. "Oh yes," said he, and took me to a miserable little mosque, with no appearance whatever of antiquity, though he assured me there was some old Byzantine work inside. However, I told him this would not do, and he must try again. So, the next morning, he took me to a real Theotocos, still used as a Greek church; but though it was old, with a central lantern, it was not the one I wanted. The dedication is, I dare say, as common as S. Mary's with us. I persevered in insisting that he should find out my particular one, and showed him the print of it. At last, about a week after I had put him upon the search, he found it out for me; and, by a judicious application of bak-beesh, got me into a garden where I could take a sketch of it, and also enabled me to see the interior. This has four slender octagonal columns under the central dome; but the principal feature is the outer narthex, which presents a succession of domes. I was told its name as a mosque was *Ecclesia Zamisi*. (I see Gailhabaud and Lenoir give its name *Θεοτοκος του Αιθου*.) The triple groups of churches are a remarkable feature in the Byzantine architecture of Constantinople. That which is figured by Lenoir as the *Παντοκράτωρ*, was shown me as the *Μονή της Κοπας*. I did not see the interior. The largest of the three churches, at least that with the loftiest dome, stands on the north side. I was told that the mosque, which comprises the whole group, is called *Starros Zamisi*. If this is taken from the original dedication, one of the churches must have answered to our S. Cross. Lenoir's *Μονή της Κοπας*, if I am right in identifying it, for my sketch does not quite coincide with his cut, is a triple church with the largest dome in the centre. There is some good mosaic work left in one of the smaller domes. The name of the mosque, I was told, is *Cachres Zamisi*.

Another triple church, of which I have never seen any print or description, was shown me as S. Demetrius. This also has its largest dome in the centre. But the southern church is the richest, and has the columnar arrangement under its dome, though one only of the columns is left standing free; one being built up into a wall, and two cut away for the purpose of throwing the several buildings into one. This, by the way, proves what I have said as to the smallness of the weight actually dependant for support on the columns. The eastern dome is Turkish, and I suppose altogether modern. The name of the mosque is *Fetia Zamisi*. As I know nothing of the language, I cannot answer for the correctness either of my spelling or pronunciation. I give the names in the best way I can, to help you in finding the things. The external lantern, in most of these examples, is either round, as in S. Irene, or of a polygonal form more nearly approaching to the circle than the octagon. Many of them have engaged columns at the angles, and arched faces, in which, however, the segmental arch prevails. The ends or fronts of the buildings show the cylindrical form of the vaults.

And now to wind up with a few practical inferences. Will the buildings we have noticed furnish us with any available hints? There is much beauty, picturesqueness, and elegance in their outline; their proportions are often remarkably pleasing; and they are treated with a breadth and simplicity from which we might well take a lesson. I have not observed in them any miniature reproductions of constructive features; such as useless blank arcades or panelling. A full scope is given for very delicate and refined workmanship; but where this is not to be had, the commonest brickwork is made to counteract any baldness or meagreness of effect. A good and useful internal area is secured, with little or no loss of space; the construction is sound and durable, and the materials of the whole building, roof included, are, or may be, perfectly imperishable and indestructible. The architects of the revival by no means neglected these examples. During the autumn before last I had the pleasure of passing a few days in Venice at the same time with a distinguished member of your Institute, Mr. Penrose, who I think will bear me out in my admiration of the beautiful little church of S. Chryso-

tomo, which we visited together. It is a regular Greek church Italianised, with central dome, Byzantine pendentives, and cylindrical roofs. Its four piers, situated as in the examples we have noticed, are of a proportion even more slender than that of classical columns, in fact the whole framework of the edifice is so slight, that it has been thought necessary to connect the springs of the arches with iron ties. It must belong to the earliest period of the revival. We have the plan of the Greek church with four columns, in S. Martin's, on Ludgate Hill, and in All Saints, Northampton; but in the former the central space is vaulted, instead of domed; and in both the columns are connected with the walls by entablatures instead of arches.

If the little church of S. Saviour, in Athens, were transferred bodily into one of our cemeteries, it strikes me that a more beautiful chapel could not be devised to occupy such a position. But we may go further than this. Let us suppose a plan nearly similar in size and arrangement to S. Jason in Corfu, only cutting off what would be to us superfluous excrescences, and substituting columns for the eastern piers. We might, I suppose, safely give a span of about 20 feet to the dome and principal arches, and about 10 to those between the columns and walls. The whole area would be upwards of 40 feet square, broken only by four columns, which need not exceed two feet in diameter. This would make a roomy and convenient church, subject to very little clerical eclipse. Its proportions, if carried out according to our Byzantine examples, would be rather lofty. The nature of the construction suggests the manner of treatment. In the first place, solidity and thickness of outer wall, whatever be its material, is indispensable. In the next place, the columns themselves I would have monolithic if possible; of the firmest and hardest marble that can be procured, or, still better, of granite, porphyry, or serpentine; in any case, a material not liable to split, peel, nor suffer injury from vertical pressure. The beauty of the whole building will depend much on that of the columns. If a classical order be adopted, the Corinthian, or even Ionic, is to be preferred to the Tuscan or Doric, because in these latter the angles of the abacus are without support from beneath, while they bear much of the weight above. I need not stop to explain why this objection applies in the case of the arch, but not in the case of the entablature. If the Corinthian order be employed, the capital should be spread out, as at Spalatro, to receive the spring of the arches. As the masses above the columns would not admit of the addition of superfluous matter, on account of weight, nor of such subtraction, on account of strength, and the construction demands that the rib of the arch should have little or no projection beyond the surface of the barrel vault, we must not count upon deep architectural mouldings, or sunk or raised ornament, among our means of decoration; and are consequently thrown upon the same resource with the Byzantine architects, namely, the employment of colour, an art which cannot better be studied than in their works. However there are several positions in which cornices, strings, and horizontal bands of carved work may be introduced with propriety, and be so managed as to secure the general effect from an appearance of poverty, even should the use of painted glass render mural painting inadmissible. I will not say it would be impossible to Gothicise a church designed on this plan, but it does not naturally suggest a Gothic mode of treatment, even should the pointed arch be used in preference to the round one. The plan would be found very tractable in revived Italian, nor does it seem to require the introduction of any features which have been pronounced unmeaning or inconsistent. And without avowedly imitating Byzantine ornament, we might borrow from that much which is really excellent. The treatment of the outside would afford scope to the genius and taste of the architect. Though I rather admire the Athenian dome, I would not recommend its adoption; it might savour too much of mimicry. The more ordinary forms admit of much variety of design. The fronts, in their simplest form, present a gable which is flanked by wings finishing at the top in a horizontal line. Here are two Renaissance buildings which suggest different modes of dealing with this form. One gives a predominance to the horizontal line, the other to the

vertical. Perhaps the latter is the best, as the projection of the central compartment gives abutment where it is most wanted. The west front of the old cathedral of Athens (given in the photograph) is a good and not unclassical composition, and the transept of the *Acropolis* furnishes an available suggestion. But the accomplished architect will 'know instinctively what to reject as mannerisms, and what to secure, as having an essential value, independent of style and fashion.

I have sometimes been accused of coming home from a tour with my head full of the last thing I have seen, and recommending its imitation in preference to anything else. I assure you this is not my case at present. I do not like the Byzantine style because I have seen a few examples of it, but I went to see those examples, because I liked what I had previously learnt of the Byzantine style. The objects themselves were new to me, but their types had long been familiar to my imagination, and I welcomed them rather as old friends, than as fresh acquaintances.

As the revivers of Gothic architecture disclaim the imputation of mere copyism, and profess their aim to be development, I can only wish them every possible success. But I am unable to get rid of the impression, which grows stronger upon me the more I study the subject, that Gothic is the style of an age very different from our own, and cannot easily be transplanted into the present century. No doubt, whatever really good national style we may strike out, must have a great deal in common with Gothic; for so grand, beautiful, and powerful an emanation of human genius cannot have passed away without leaving deep and lasting traces behind. But of those striking and characteristic features, by which the style is identified, and which constitute its charm to its admirers, the greater part, I fear, will be found to have been impressed upon it by an age and tone of society long gone by, and will gradually fade away on its development to meet the views and exigencies of the present. Whereas the classic styles, and those more immediately derived from them, whatever faults or incongruities they may exhibit, however they may have been debased from time to time by incompetence or misconception, show that they are grounded on forms and principles of beauty which neither age nor fashion can affect.

MR. BREESFORD HOPE, Hon. Fellow, moved a vote of thanks to Mr. Petit for his admirable paper on Byzantine architecture. Every one, whatever his particular views as to the best style for the architecture of the future, could have but one feeling, and that of gratitude to those who, like Mr. Petit, consistently, laboriously, and enthusiastically, endeavour to impress on others their own opinions. But notwithstanding the great interest which Mr. Petit took in his studies, and his anxiety to carry out as the style, in the future of architecture, which should as admirably represent the age of the swallow-tailed coat and chimney-pot hat, as the classic might have represented the flowing robes of Rome, or the picturesque dresses, or rather no dresses at all, of Grecian statuary—he hoped, whatever style might be ultimately adopted, it would be one in conformity with the common sense and good taste of the age; and perhaps that might not be the one displayed by the drawings on the walls. Whether or not the Gothic might be the style, it was not for him to determine, but there was no doubt that, for the last fifteen years, there had been a strange consent on the part of almost all English architects to adopt that style for ecclesiastical purposes. If he might hazard a conjecture as to when the revival of that style began, he would attribute it to the publication in 1842 of "Brandon's Illustrations of Parish Churches," a book to which the school of modern architecture was more indebted than to any other issued either before or after it. The buildings shown this evening were, if not very small, still not large enough to hold such congregations as (he would not say our great cathedrals) our first class parish churches were capable of accommodating. They were evidently built to meet the exigencies of a particular climate, and the requirements of a religion in which mere ceremonial without any teaching seemed to have been the animating spirit. He did not think that buildings of

that kind could be absolutely and unchangeably adopted for our model. Nor could he persuade himself that derived as those buildings might be from classical types, having mouldings and details which, though neither exactly Grecian nor Roman, yet had a pedigree to be traced up to those styles, with arches of that rounded form which Rome developed, and by which she altered the Grecian style, and which from Rome was again imported into Greece—he could not persuade himself that the details of those buildings could lay claim to that purity of style, exact proportions, and simplicity of detail which characterised the Athenian Parthenon and the Erechtheum. Fond as he was of the Gothic, he could yet have a great admiration for the Byzantine school—an admiration, however, founded on its classical pedigree. We either must confine ourselves exclusively to one school, or become the advocates of those mixed and derivative styles, which have flown from the one great fountain of classical architecture. He believed, however, the admiration for these mixed styles to be founded on mere personal predilection, and not to be capable of philosophical demonstration.

Mr. M. DIGBY WYATT, Hon. Sec., said,—However different the roads by which men endeavoured to ascend the hill of science and of art, still they had one common object in view. He believed the explanation of the great differences that had arisen between the partisans of various styles of architecture was, that they were anxious to convert that which they most admired themselves into a type for universal adoption. Now it was quite possible to appreciate in the highest degree the beauties of any particular style, to feel most intensely the charm of its historical reminiscences, and to endeavour to retain every practical part of the symmetrical proportions on which it was based, and yet not to desire to see that style carried out to the exclusion of every other. It was very commonly said in the present day, that the future English ecclesiastical style must be a sort of *olla podrida*. A singular concatenation of circumstances tended to produce this peculiarity. By means of engravings, hung up in nearly every house in the inhabited world, and of photographs, we had the opportunity of studying all that had been done in different times. But it would be most unwise and prejudicial if, because we admired and recognised the beauties of strictly classical architecture, we shut our eyes to the elegant plans and picturesque forms of other styles; and because we admire these Byzantine remains and beautiful colours, to neglect the Gothic. Each of the various styles of architecture was to be admired in proportion to its intrinsic excellence. He believed, the real solution of the difficulty might be found by taking our natural taste and wants as the base of operation, and that it was possible to arrive at a perfectly original style, suited to the purposes for which a building was required; and which, although it might remind us occasionally of some particular style, should yet be almost, if not perfectly, original, simple, and beautiful.

With reference to the suggestion of Mr. Petit as to the use of brick in ecclesiastical buildings, he must confess that in towns he did not like to see a Gothic church rising out of a mass of brick buildings. It might be very beautiful in itself, but he should prefer to see such a church in a more rural situation. He thought the churches described this evening well adapted for towns, because rising from among our ordinary town brick buildings, they might be made to harmonize with them. He believed they could be erected very economically, and that for religious services they offered advantages considerably greater than those constructed on a Gothic plan. Adopting the Gothic style with limited means prevented justice being done to that style; and want of funds would often compel them to have thin walls, unsatisfactory columns, and slight timbers. It might be said that the mouldings were quite correct, and all the work perfectly according to authority, but still he contended that was not the proper way of carrying out a design, and he did hope that if we could not afford to work in Gothic well, we should be content with a more humble style of architecture.

Mr. ASHPITEL, Fellow, would call attention to the extraordinary story alluded to by Mr. Petit, that when the Emperor Justinian was told that the arch would not stand with the centre in it, he

ordered the centre to be knocked away, and that then the arch did stand. The subject had been noticed by a French gentleman in a letter to Mr. Birch of the British Museum, stating that the asserted suggestion of Justinian was entirely a piece of flattery of Procopius, and that so far from its being true, the fact was that the building, as originally constructed, was a complete failure, and that the whole design had to be altered. This gentleman had not made a note of the author from whom he had extracted the passage, but thought it was to be found in "The Anecdota," a later work of Procopius, in which, however, he (Mr. Ashpitel) could find no such passage. Several of his friends thought they remembered the passage, but as the Byzantine historians filled some some forty folio volumes, he was afraid the search for it would be tedious. There had always been a tradition that the Byzantine forms were derived in some way or other from the Persian and Arabian. In some of the Byzantine specimens, there was a dome with four domes, one on each side of the large dome. Then there was a not very different form of dome at St. Mark's at Venice, and at Padua, one large dome in the centre with four smaller domes around it. Now this was very much the form of the buildings in Egypt and Persia—he would ask Mr. Petit whether there was anything in these Asiatic buildings resembling the pure Byzantine?

MR. PETIT said that he knew nothing of those buildings except what he had seen in Mr. Fergusson's work. He did not see in them that particular form of pendentive—the Byzantine pendentive—but the Roman pendentive was used.

MR. CHARLES BARRY, Fellow, said he had felt some difficulty in comprehending the reason of the very common introduction of the bars across the openings of arches in Italian churches. According to one account they were almost always found in churches in countries subject to earthquakes, and where the foundation was not of a stable character. But they had been used in places where earthquakes were never known to occur. He believed therefore that some of those structures had such severe thrusts and counter-thrusts to endure that they could not exist in any country without such aids. Mr. Petit mentioned only one Byzantine example in which he had seen an iron tie bar. If that were an exception to the rule it showed that the Byzantine style was good in point of stability. The difficulties which Mr. Digby Wyatt had mentioned as arising from limited means would be experienced in building in every style as well as in the Gothic, and the architect would be driven to economise by some means or other. He had been induced to think the great argument in favour of Gothic churches, and one reason for their almost universal adoption during the last twenty years was, that Gothic was more plastic and susceptible of expansion than any other style. He could not help thinking decidedly that the same amount spent on a strictly Gothic church would produce a far greater effect than if expended on one built in any other style. It was often said that we must not attempt a particular style unless it was to be carried out perfectly. Now it was very well known that it would require as large or larger an amount of funds to carry out the Byzantine as the Gothic.

MR. PETIT said he never observed any Byzantine buildings where iron ties were necessary, except in a little Byzantine building in Venice, the church of St. Crisostomo; but he did not believe there was a single tower in Venice that was quite perpendicular, and many were very much out of the upright. He did not, however, remember in any of these Byzantine buildings which he had seen that there was any necessity for iron ties. The columns were of very hard, good material, and, no doubt, perfectly capable of bearing a very great weight, and generally the arches were so constructed as not to throw so much thrust into the internal area, as some other kinds of arch did.

MR. PENROSE, Fellow, said that the church alluded to, as well as almost all in Venice, had iron ties, which were very common in Italian buildings, and there universal. The church of St. Crisostomo was a good illustration of the capabilities of this style; and he remembered Mr. Petit remarking

on the spot the very great fitness of the building for the worship of the Church of England. As to these iron ties, he would observe that the Italian architects in one or two instances seemed to have protested against them. In all the works of Brunelleschi they were excluded, his consummate mathematical skill having led him to discard them. With respect to the admirable concluding hints of Mr. Petit's paper, he was induced to think that when fashion, or practice, or other causes had driven English architects into the Gothic channel, it was impossible for an individual architect, or even a body of them, to set themselves against it. It was to be regretted that the earlier Christian types had not been more tried in this country. The church recently built at Wilton, as an instance, afforded him the greatest pleasure, and he wished that the Romanesque and Byzantine styles had been more frequently adopted, though he must own that he admired the Gothic almost, if not quite, as much as any of its advocates present.

Mr. JENNINGS, Fellow, said that architects building churches had almost always too small a sum at their command. When there was sufficient money he should be very glad to see the classic style adopted, and he believed the reason why it was not introduced was its great excess in cost over the Gothic. There could be very little doubt from the drawings on the walls, that the construction of Byzantine churches would be more expensive than Gothic ones of the same magnitude. With regard to the specimen church shown by Mr. Petit, which he supposed would accommodate only about 300 persons, he thought the construction not well adapted to the requirements of the English service.

Mr. PETIT said he was not giving these churches as exact models for construction, but as ideas for development. He drew that specimen church for the sake of showing how the original type might be modified. There was no necessity for a perfect square on plan, but it might be lengthened transversely, or else in the direction of the central passage. Moreover he had not given it as a model for cheap church architecture, as a dome was required, and consequently lofty proportions, all which were unfavourable to cheapness.

Mr. DIGBY WYATT, Hon. Sec., in reply to the observations on the comparative cost of construction of the different styles, said, the minimum of what was wanted in a church was the simplest arrangement possible; a series of arches, columns, doors and windows, and, if the internal area was very wide, besides the side windows the middle of the church must be lighted from the top. A roof was essential, executed in as presentable a form as might be. But when an architect was restricted to a totally inadequate cost, he was reduced to adopt the strictest economy, and all he could do was to take care that the doors were well shaped, that the columns had good shafts, capitals, and bases, and that the windows, whether round or flat headed, were well proportioned. If that was done it satisfied the eye, and required only the plainest and most natural working out to express, and accord with the object of the building. But as soon as he affected the details of any historical styles which could only be properly carried out by neglecting strict economy, he challenged a comparison of his work with buildings of a more costly character, which must tend to the disadvantage of the cheaper structure, and show that the architect had not accomplished his intentions, but had produced something neither Gothic, Byzantine, nor Classic, something, in fact, that aped to be what it was not.

Mr. BERRISFORD HOPE said, if we were to adopt as the basis of future operations what had been thrown out this evening, he hoped they would not fall back upon tradition, but would look only to what was practicable, and suitable to our race and climate. With this view he thought the Byzantine not the style to be adopted, as it was quite evident that, without a departure from the designs displayed, it could not be adapted to the requirements of the present age. Rightly, or wrongly, architects had agreed that for Englishmen of the 19th century, the style of the 15th, the 14th, or even the 13th, was as likely, perhaps more likely, to approximate to their requirements than the style adapted

to the hero worship of the Greeks of the 4th century before our era, or even the style of the Romans of the 4th century after. The climate was still the same, the language was substantially the same, and the Christian religion, whether before or after the Reformation, was at least more nearly related to the Christianity of any age than the paganism of either Greece or Rome. So that, unless architects were at once, without any example at all, to start for themselves and ex-cogitate a new style, if they wished to ensure legitimate and moderate results to meet the wants of the age, they were far more likely to succeed by, and would have something like an intelligible starting point in taking up the style which had satisfied our grandfathers and great-grandfathers in the days when they had the same Parliament, the same laws, the same Royal race upon the throne, the same Magna Charta to fall back upon, and the same good old language to speak as ourselves. If a very cheap church were wanted, there was there a cheaper style than that in which the pillars might be merely circular, with only one or two mouldings, and the arches merely fulfilled their structural purposes? It remained to be seen whether the Byzantine would be tolerable if carried out in that very plain form. In this old English style, the types which were to be seen in the villages of Surrey and Sussex, that was perfectly legitimate, although it might be wanting in the higher attributes. Under these circumstances, again repeating their acknowledgments to Mr. Petit for his excellent lecture, he trusted they would all go away unconvinced, and not throw to the winds their practice and their teachings of many past years, and build churches which, although they looked well in Athens, would be totally inappropriate in London.

MR. THOS. HILL, Visitor, thought the Byzantine style more simple than the Gothic. It had been said that iron tie rods were common in Italy, and some reference was made to earthquakes rendering them necessary, but earthquakes had not happened at Westminster, and yet in the Abbey there were very strong iron ties. He imagined that the Italian architects had used them for the same purposes as our ancestors at Westminster.

MR. POCOCK, Fellow, said, it was not only in Italy that iron ties were used; there were strong ones at St. Pauls as well as Westminster Abbey, and many churches would be much better with them. The extensive adoption of the Gothic style for churches during the last fifteen or twenty years he believed was to be attributed to its being a distinctive style for buildings devoted to public worship. In the country it had prevailed for a long time, and when the number of churches in London had been increased, the Gothic style had been more extensively adopted than perhaps was consistent with good taste. He would confess to disliking to see in crowded parts of London a church which would be very suitable in the country.

MR. CHAS. BARRY, referring to iron ties, said, the question was, not whether they should be considered improper where applicable, but whether any tie should be inserted across the opening of an arch, which arch proceeds on the assumption of disdaining such assistance. That was the fallacy particularly exemplified in the Italian buildings, in all of which they had been built in the original structure; but his impression was that the ties in English buildings generally were after additions rendered necessary by the over ingenuity of architects presuming too much on their powers of construction.

The Chairman, MR. SCOLLS, V. P., said, that after a church had been neglected perhaps for centuries, and the pinnacles knocked off, of course there was a want of weight and pressure to keep the piers in their places, which necessitated the introduction of ties. In Italian buildings he could never make up his mind whether they were built in originally or were put in afterwards.

The votes of thanks having been passed, the Meeting adjourned.

DESCRIPTIVE PARTICULARS OF THE REMAINS OF KILCONNEL ABBEY, IRELAND.

By JAMES BLAKE, Architect.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, March 22, 1858.

AMONG the numerous tourists and archaeologists who run round the country every year, there are but few who know that the West of Ireland, the county of Galway in particular, abounds with remains of the most important character, as exemplars of Ireland's only perfect style of Mediæval church building, and of its peculiarity as compared with the contemporary styles in England. From among these remains I have chosen the present for illustration, in consequence of their comparatively good state of preservation, and of their being perhaps the most peculiar in mass and detail.

Kilconnel, a village to which the Abbey gives its name, lies about ten miles distant in a westerly direction from Ballinasloe, thirty from Tuam, and twenty from Loughrea. The country for very many miles round is comparatively flat; the tower consequently constitutes a very important feature in the landscape from numerous points of view. Like that of most of its class, the history of Kilconnel is scanty, being almost limited to local traditions. The name is derived from two Gaelic words, *Kil*, a burial place, also cell, and *Chonnale*, or Connell, the name of the person who founded the Abbey in the territory of Minitch and Hyamen, and was a contemporary of St. Patrick. His establishment, however, soon came to an end; and in 1400, William O'Kelly erected a house here for Franciscans. On his death, in 1420, his son Malachy undertook a more extensive scheme and completed the whole about the year 1460, to which period I consider that most of the present remains belong. It is recorded, that the supposition of James the First being favourable to the Roman Catholic cause occasioned most of the religious houses, not in too ruinous a state, to be repaired and re-occupied by monks or friars. Among them, up to the year 1604, we find the names of Multiferham, in Westmeath; Kilconnel, in Galway; Rossariel, in Mayo; Buttervant Kilkroe, and Timoleague, in Cork; Quin, in Clare; Garrinlough, in Devenish; with others in the cities of Waterford and Kilkenny. I find, however, no traces of repairs characteristic of this period at Kilconnel, and I am led to suppose that the works were confined to re-roofing some portions, and filling up the tracery of some of the windows with masonry in lieu of the original glass. An inventory of the Abbey while complete mentions, besides the church, a house called a 'Council House,' (Chapter House?) a chapel called "Tonhill Donelan's Chapel," six chambers with fire-places, twenty-eight small chambers or dormitories, three orchards, six gardens, a mill and water-course, and sixty ash-trees. Tradition points out the site of the mill, but the water-course must have been considerably diverted. Of the ash-trees, one only remains, which, from its great size, must be of considerable age. It grows in a very extraordinary position within the walls, and against the East window of Tonhill Donelan's Chapel. The trunk, at the height of six or eight feet, divides into two arms; one grows out through the window, the other upwards, but both unite their branches above the wall in one mass of foliage. The position of this tree fixes the ruin of the chapel at a remote period; even though the chapel is shown to be an addition to the original building, by its character, and by not being "tied" or "bonded" into the work of the transept. There is no doubt that Kilconnel Abbey, in its

pristine condition, was a very important establishment in the West ; and that it had many endowments from numerous ancient families about it, whose descendants are still existing. Many interesting reliques have been from time to time found in the locality, particularly in a small swamp or morass to the North of the Abbey. It would appear, that at the destruction of the monasteries the friars or monks took the precaution of concealing their valuables in the adjacent bog, either on account of the supposed preservative qualities of the turf, or of their being secure from discovery by marauders. From this cause, no doubt, the small bog near the Abbey of Kilconnel retains to this day the cognomen of "Moan-na-mraibhar," or "Friar's Bog," and various reliques of the old Abbey have been found in it from time to time. Some years ago, an ingot of fine gold of considerable value was dug up.

Like those of most communities of the class, the founders of this took good care to secure a spot where fuel and water were abundant. In addition to the excellent running stream alluded to, there is a spring to the North, of the most exquisite quality. It is commonly called the "Lanthorn Well," but I find that the proper appellation is "Lanfiera's Well," the name, I should conjecture, of one of the abbots, or of a local saint. In most other Western monasteries, such springs are generally called "Holy Wells," and are commonly reported to possess healing qualities for all diseases.

The entire structure of Kilconnel Abbey is built in flat courses or layers of flint, and flags of various sizes and qualities, principally self-faced. It has as good an effect as the most perfect style of masonry. All the finer or wrought work is of the exceedingly hard limestone peculiar to Ireland, but found nearest to Kilconnel at Brackerna, near Ballinasloe, about twelve miles distant. The very hard quality of this stone has allowed the highest finish to be given to all the work, and the greatest exactitude to every detail ; while such is its state of preservation, that the chisel marks are as fresh as might be expected only a year after completion. The marks are very fine, in consequence of the sharpness of the tool required to disintegrate the stone ; but they still remain, and, with one exception where the stone is rubbed or polished, they form the finish of the work. Doubtless, the expense of first class artisans to work this stone, and the labour and time it must have required, have occasioned the introduction of a small amount of ornament ; but wherever it does appear, it bears the impress of masterly and free treatment. We cannot attribute the use of this very hard material to anything but the necessity of using local materials, but the result is forcibly in favour of hard stone in monumental buildings, with a small amount of ornament accurately finished, in preference to many ornaments badly executed in soft stone, and the consequence—early decay and premature destruction.

Every traveller who has given his ideas upon these structures has emphatically pronounced them to possess a very foreign aspect. Probably in none is this more evident than in Kilconnel, whether viewed in the mass, or in the detail. One of its greatest peculiarities is, (should my assumption of the date not be erroneous) that, while at the period of its erection Perpendicular Gothic was the only style practised in England (and to a far greater extent than the preceding ones), we do not find any evidence of the slightest influence of the English style or taste at Kilconnel, so far as broad principles give scope for consideration. But in France and other continental countries, where the Perpendicular never obtained proper hold, we find the same flowing style as that of Kilconnel, and just about the same period. The East window, the South transept and the chancel windows are decidedly Flamboyant, and entirely devoid of any cusping. Of all the traciced windows, the South window of the aisle alone is cusped, and has any impress of English character ; and this only if Mr. Garbet is correct in asserting, in his "Budimentary Treatise," that the difference between our own flowing style and that of the Germans and French is, "that while the upper ends of our loops or leaves are round or simply pointed, *i. e.* with *finite angles*, the upper ends in France terminate like the lower, in *angles of contact*." The only English windows showing the same mode of treatment

as this which I can call to mind, are the West window at York Minster, and a window in Kirton church, Lincolnshire. The square headed Tudor looking windows in the aisle of the nave are very well executed, but too much frittered away in lines and small members. Another difference in respect to the windows is, that while in England they are generally recessed with a bold single or double chamfer, or otherwise more deepened and moulded, in Kilconnel they are fixed in every case within an inch, or an inch and half of the face of the wall, and sometimes flush with it. This I consider to be a decided fault; æsthetically, because it deprives the window of shadow necessary to give it boldness; and, constructively, because it tends to expose it more to accident. Many of the windows have no splay inside. The three-light window above the eaves line in the South wall of the chancel must be a much later addition.

After a few leading elements in the nave and chancel, irregularity and want of symmetry seem to be the prevailing features in Kilconnel Abbey. The windows do not correspond with the nave arches, and equidistances are almost disregarded. Arches differ in height and span, and those parts which, notwithstanding the irregularity of outline, generally exhibit some degree of balance, are here irregular. Except in the principal windows and in some doors which have equilateral heads, all the arches approach more or less the semicircle, or are very flat in comparison with their span. In England, about this period, this effect was generally produced by four centred arches; but here it arises from the striking centres of the arcs being set nearer the positive centre of the arch. In the nave this is the case. In the cloisters, the arches are nearly round; and in the transept they are so slightly pointed, that a practised accurate eye alone can detect their true form. This method gives an opportunity of combining the perspective grace of the semicircular arch with the structural stability of the pointed. The archivolts are either entirely square, as in the cloister; or they have an additional square rib to the intrados, as in the nave and transept; these are sometimes chamfered, as in the tower. The excellent constructive precaution of beginning the relieving arches considerably above the haunches, so as to bring the thrust more perpendicularly on the pillars, has been followed in every case. There is no trace whatever of a buttress in any part of the structure. In all probability, the necessity of making the walls very thick in consequence of the description of masonry employed, combined with the circumstance of the roof being of wood, obviated the requirement of any buttresses; and a plinth is also superseded by giving the walls a batter from the ground-line to about six or eight feet above it.

It would appear that the transept and aisles were a sort of after-thought in the erection of the main structure,—but that both were built during the same period cannot, I think, be for a moment doubted. Not so, however, "Tonhill Donelan's" chapel. This certainly, as previously stated, must be an addition subsequent to the main erection. I presume that "Tonhill Donelan" erected this at first as a mortuary chapel, and that afterwards it was used, in conjunction with the transept and aisles, as a chapel for the general services; high mass and the more solemn ones being performed in the chancel. Squints in the side arches, now almost effaced, enabled the worshippers to participate more easily in the services at the altar at the East end. The piscina in this little chancel is of the most exquisite finish, and seems to be of a different material from the rest of the work; a sort of dark marble, which had at one time, no doubt, a fine polish. The arches have the same characteristic as those already mentioned, *i. e.* a near approach to the semicircle; and the pillar, its ante and their capitals and bases, have very free and beautiful profiles. This piscina is, perhaps, one of the most finished and exquisite pieces of work in the whole fabric. Indeed, it is more reasonable to assume that it was removed from another site in the church and inserted here, than that it is of a contemporary style with Tonhill Donelan's addition. The other piscina

in the transept also shows highly finished workmanship. There is little doubt, judging from the height of the East window above the floor line, and the raked appearance of the wall, that a *rearedos* existed above the altar; but the place is now so encumbered with tombs and ruins, that it is impossible to arrive at any satisfactory conclusion. There is no trace left of *sedilia* or a *piscina*, in the chancel, though it, no doubt, possessed them; and the fact of two *piscinas* being found in one small chapel, made up of various parts into what might be termed the "Lady Chapel," leads to the conclusion, that the most important and solemn portion of the edifice would also possess these adjuncts to an extent commensurate with its importance.

The roof must have been an open timbered one; the stone corbels, of the plainest description, which supported the ribs, still remaining in many places, particularly in the chancel.

The distribution of the little amount of ornament to be seen is singularly peculiar. A few leaves are found on one of the main springing courses (and only on one) of the tower. An angel with a book supports one corbel only of one of the tower arches; and in one corner, above the springing of the arches, an owl is carved in bold relief, as if stuck against the wall. At the junction of the nave and transept aisle, is a springing stone of nearly the same profile as the more elaborate capitals in the transept, but having a running *fleur-de-lis* on the frieze. In other places small scroll devices, little bits of leaves, &c. are found.

The tower is a remarkably strong and solid structure, the walls retaining their thickness for nearly their whole height. The floor is nicely drawn to the square by a series of discharging arches—the groined ceiling under is of excellent workmanship and finish, having no bosses at the intersections of the ribs, which are too often the means of concealing indifferent work. The whole is well done, and "line meets line" with geometrical exactness. The stepping in of the upper portion of the tower leaves considerable spaces outside to the North and South—these are but very slightly weathered, and in so peculiar a manner as to render their use a mystery. The weather stones, each in two steps, are hollowed considerably in the middle in the direction of the drip, so as to resemble tiles; and each of the platforms has a door at about its own level, but about six feet above the floor in the tower—its purpose I am unable to conjecture. The most remarkable feature in these monastic towers, all of which in some measure resemble the one in question, is the termination, which entirely differs from anything of the kind in Great Britain. All those I have seen are finished in the same way, or at least on the same principle. Those of Jerpoint, Clare Galway, and Abbey Knocking, may be cited as instances. Above the top string course (it cannot be called a cornice) is a series of oblong holes through the parapet, carrying the water from the roof to the drip of the string course. These, at some little distance, produce almost the effect of large *denteles* reversed, and give a peculiarly pleasing weight and importance to the upper portion and battlements. Such battlements, according to Fergusson, are identical with many found in the North of Italy.

The tower contained some excellent bells, but the number is doubtful. If a peal, they would, in all probability, be rung from the floor carried by the present groined vault; but as there are two rope-holes in this floor, it is likely that there were only two bells, and that they were rung from the ground-floor, or the one above. There are, however, housings in the walls at the top of the tower sufficiently large to admit the framing for a peal of at least six bells; but the windows, or sound holes, in this part are too small for such a peal to be safely and effectually rung. One of the bells of fine and powerful tone was discovered in the adjacent bog, but after being kept for many years it was accidentally broken and disposed of.

The Abbey, in its finished condition, must have possessed many splendid monuments and tombs, but most of them, from wilful destruction, or neglect, are entirely defaced. That in the nave,

however, near the West door, would be found, were the ivy removed, to be in a tolerably good state of preservation. The altar part of this tomb I should consider, from the character of the figures, to be a century or more earlier, but the canopy and its adjuncts belong to the date of the present church; and if the lower part is older, it has most likely been transferred from some older structure that occupied the same site. The canopy is a splendid piece of workmanship of very delicate finish and adjustment. Fault may be found with the multitude of small members into which it is cut up by the alternate hollow and round mouldings, but the accuracy with which these members are mitred upon spherical lines deserves great commendation. The character of the tracery is as Flamboyant as anything in France or Germany, and certainly different from anything of the kind in England that I am aware of. There is no history of this tomb extant: it belongs to the "Keogh" family, and is commonly called "Miss Keogh's tomb." The monument to Hyacinth Daly in the chancel was, with other portions of the remains, blown down by the great storm of the 6th of January, 1839. I am indebted to the Rev. John Day Collis, for a rough sketch taken before its fall, from which my drawing was made. The tracery, it would appear, was entirely of a geometrical form, or at least composed of circles and segments, inscribed and tangential: it is the only portion showing exact geometrical properties I have found connected with the building. This monument, though commonly called Hyacinth Daly's tomb, is the family vault of the Dalys, of which the present Lord Dunsandle is one of the principal members. There is little doubt that there once existed a superb monument to William and Malachy O'Kelly, the founders of the present structure, but not a vestige remains. None of the tombs seem to have had recumbent effigies, so frequently seen in England.

I have tried in vain to discover any portions of the inside covering of the walls, though they have evidently been plastered. My object was to discover whether any frescoes remain, as it is certain that many of these buildings had very valuable ancient pictures of that description. It is very highly probable that Kilconnel was similarly decorated, as all the wall space to the North of the nave and chancel was available opposite the full light from the South. There can be no doubt that the larger windows had stained glass, as many pieces have been discovered among the rubbish. We do not often find that frescoes and stained glass combined produce a good effect; the brilliancy of the transparent material not agreeing with the opaque dulness of the other. This is observable in Italy and the brighter Southern countries. In the present instance, with but a very moderate light coming from one direction, I cannot see that their combination would be at all incompatible. The flood of light from the South would fully illuminate any frescoes on the North wall; and the subdued light from the East and West would give ample scope for stained glass, without producing any overwhelming brilliancy. Indeed, the light, particularly in the nave, must at all times have been much subdued, as in the Italian churches.

There is nothing in England, of which I am aware, that at all resembles the cloisters at Kilconnel. In England, the cloisters generally consist of a series of windows lighting a quadrangular passage; but those at Kilconnel and the neighbouring monasteries exhibit a series of open arcades, supported by pillars; either single oblong piers, as at Moyné Abbey; or double pillars, though not exactly detached, as at Kilconnel. The latter are a sort of simplified arrangement of those found at Huelgas, near Burgos, in Spain; and at Pontevault (though the latter are not pointed) in France. They have imposta, capitals, and bases (however plain) similar in arrangement to those mentioned, but not detached, and pointed arches of stiff radii, and flat intrados. It is very evident, that, like the Spanish and French cloisters, those at Kilconnel were never glazed. The arches very nearly approach the semicircle. Diminutive as these cloisters were, their uncovered area being only 22 ft. square, they seem to have been divided in the middle by a partition or arcade running East and West, the purpose of which I am unable to conjecture.

Of the monastic buildings, there are but comparatively few remaining at Killoconnel, and those the least important. They are, however, in tolerable preservation. The general plan of these monasteries may be described as an irregular quadrangle; with square cloisters as the centre, surrounded by the church on one side, generally the North (in this instance the South), and by the monastic buildings on the other three. The only one of the existing apartments possessing a name is called the "Strangers' Room." I presume it was appropriated to benighted travellers, who always obtained bed and board, as well as other relief, at these institutions. Above it is a well-lighted room, which I conjecture to have been the "Abbot's Oratory," an apartment generally placed at the East end of the church. A large mass of masonry with recesses was, I presume, the cooking fire-place of the establishment; and I have called the apartment in which it is found, the kitchen. The other apartments—as the refectory, chapter-house, &c., I suppose occupied the respective positions I have assigned to them; while over all, excepting probably the chapter-house, extended the dormitories and remaining portions of the establishment. One building, connected with the main body by a blank wall, remains in a very good state of preservation. It has two stories, the upper one lighted as the dormitories, but the lower entirely dark, the only entrance being from the East by a narrow doorway 18 inches wide. I can assign this building to no other use than that of a refractory cell or prison, with a keeper's lodging over it. There are ruins lying still further to the North of this building, which indicate that the establishment extended over more ground than at present. Many large tombs and ancient tablets, dating as far back as the Commonwealth, are to be found in all parts of the church; and the monastery seems to have been the place of interment for various ancient and important families for miles round.

In conclusion, I venture to express my opinion that the architects of all these Western monasteries, Killoconnel in particular, were either foreigners; or that, if natives, they studied in foreign countries, and thence imported the style into Ireland. The latter opinion is perhaps the more correct, as it is very probable that, as in England, the bishops and clergy of the middle ages in Ireland were their own architects; and it is well known that students from Ireland went into Italy and Spain to be ordained, where it is not improbable that they studied the elements, and imbibed the principles of architecture which they subsequently transferred to their native country. Indeed, not only in the style of architecture here treated, but in all the Irish architecture of a much more ancient date, this foreign influence is always to be remarked. English feeling, or the influence of English style, is not apparent in either. This would not be so much matter for surprise, notwithstanding the close proximity of the two islands, had there been no connection between them in an imperial point of view; but when we find that, at the period to which these remarks especially apply, Ireland was under the almost absolute domination of the English, it must be considered remarkable that some English spirit was not infused into the vernacular architecture of the country, more particularly at that advanced age. On the other hand, when we remember that the Irish chieftains and their followers never could brook the yoke of their English subduers, and that at the time Killoconnel and like abbeys were built, that is, the commencement of the fifteenth century, the country was subject to serious and continual disturbances, we may understand the reasons which may have prevented the adoption of any English type. Again, we find in almost all other countries contiguous to each other, foreign influence apparent in some shape or other. Thus, in France, we occasionally find German influence, and *vice versa*, in Spain, we find French, and in Italy we find even English influence. But in Ireland, at a short a distance across a narrow channel, where English influence in other respects prevailed, and where, according to Hardiman and Debrett, some of the founders of these western monasteries must have been of Anglo-Saxon blood,

there is scarcely anything to indicate the union of the two countries, while there is everything characteristic of the spirit and thought of more distant climes and more foreign impressions.

There are many abbeys in the counties of Galway, Mayo, and Clare, which, if properly investigated, might throw much light upon a mystery hitherto not fathomed. It would be very interesting to the antiquary to discover some definite reason for the Southern influence prevailing in the Mediæval architecture of the sister isle; and why she should, in that respect, be so much alienated from this country, with which she was otherwise so nearly connected. There is food enough for the archaeologist among these ancient structures, to enable him at least to arrive at a conclusion whether their characteristics are entirely foreign, or whether they were, in any degree, affected by the influence of Great Britain.

Mr. DONALDSON, H.S.F.C., said that Mr. Blake's paper contained much useful and original information, and he was glad that an Englishman had come forward to illustrate the antiquities of Ireland in a manner not hitherto done by Irishmen themselves. It was to be regretted that Ireland had not had the advantage of a man like the late Mr. Britton, to take up the monuments of the country seriatim, and bring learning and art to bear upon their illustration. He, however, could not altogether agree with some of Mr. Blake's remarks, particularly the suggestion that foreign influence had operated extensively in the works referred to. The Flamboyant character of the tracery of the tomb and windows could hardly be taken as a proof of their French origin, and he believed that the Irish, like the Scotch, had a style of Gothic peculiar to themselves. Kilconnel Abbey represented a large class of religious buildings in Ireland, in all of which there was a remarkable identity of detail. He would call the attention of the meeting to a plan and general view of the Church at Kilmallock, drawn by himself, showing its great similarity in arrangement and design to the Abbey of Kilconnel. Kilmallock was of the Lancet period, and had buttresses, which, as Mr. Blake had stated, were wanting at Kilconnel. The cloisters in each case occupied a similar position. It was evident that the two buildings had been designed with the same sentiment. The tower was a striking feature in both, and in many similar buildings in Ireland. At Drogheda the tower alone remained, the rest of the building having been destroyed. The dark liae limestone, of which these edifices were constructed, took a good polish, but its colour being almost black had an unfavourable effect, and was not sufficiently relieved from the surrounding landscape. The peculiar openings near the summit of the tower, which Mr. Blake had described, were for the purpose of discharging the water from the roof. They were of frequent occurrence in towers of this kind, though varied in detail: on a future occasion he hoped to describe them to the Institute.

Mr. NICHOLL, Associate, said that he had visited several of these monuments of Irish architecture. It appeared to him that the later examples displayed a bad imitation of early work; as if executed by men who had seen good architecture abroad, and endeavoured to reproduce it from memory. Although in the cloisters of Kilconnel the details were bad Gothic, the general effect was very pretty. Mucross Abbey and Quin Abbey, in Clare, were similar in character to the subjects before the meeting. In the little village of Adare there were three abbeys, having details also of a similar nature. The small room adjoining the chancel on the north side at Kilconnel was, he thought, the sacristy, the room above being the treasury. The cloisters resembled those of Mucross, and also fragments which existed of the cloisters of Ballintubber, in Mayo. The latter church was very perfect and interesting. It was founded in 1216; its general character was Romanesque, and the detail decidedly good. It had a vaulted choir, and presented one of the few instances of the high altar as originally erected, and constantly used, with very rare and short intervals, down to the present time. This was, indeed,

almost the only altar of the thirteenth century which he knew of still in use. The appearance of imitation was the most striking point in the works under consideration. From what source they were derived he could not say, but he did not think they were at all influenced by English taste. Art did not appear to have been fostered or advanced in Ireland by English rule during the Middle Ages; e. g. the spire was not introduced, the few examples he had seen being quite modern, and, with one exception, confined to edifices belonging to the Establishment; and even now it was regarded as English, and as appertaining to the Protestant Church. The gutters at the top of the tower at Kilconnel were similar to those at Adare. In reply to Mr. M. D. Wyatt, Mr. Nicholl said he was unable to account for the doorway at so high a level in the tower of the church, but doors were found in very peculiar positions in other Irish buildings; he did not think they were made for the purpose of discharging missiles; the battlements on the summit of the towers generally were very slight, and it did not seem to be of a defensive character.

Mr. M. D. WYATT, H. S., said, that the Medieval buildings near Dublin, "within the pale," which he had seen, were decidedly of English character, as in the remains at Trim and Mellifont; but those of Kilconnel, Kilmallock, &c. appeared to be of a ruder class. They were produced by imperfectly educated architects, and less skilful stone masons; and he agreed with Mr. Nicholl in thinking that the elements of originality which they displayed arose from a stern necessity to supply wants similar to those which had been supplied by artists more skilful than the Irish, who remained comparatively unacquainted with, and isolated from, the experiences gained by the great masters of the craft. The Irish, in fact, invented to the best of their ability, from a want of knowledge of what others had done. He did not remember having seen an ancient spire in Ireland.

Mr. C. BARRY, Fellow, congratulated the Institute on the present paper, as an illustration of Irish architecture, to which the Council had endeavoured to call the attention of the profession. The architecture of Scotland had been illustrated by Mr. Billings, but Ireland had been peculiarly neglected. As architects should be also archaeologists, and possess a knowledge of the styles of all times and countries, it was very desirable to consider the architectural monuments of Ireland, the peculiarities of which had yet to be developed. It was hardly fair to judge of these works by the example illustrated on this occasion, and certainly he had not felt the same interest in it which he should have in many of the more important English or Scotch monuments with which they were better acquainted; but it did not follow that there were not other buildings in Ireland deserving a more detailed examination.

A vote of thanks to Mr. M. D. Wyatt, for reading the paper, was put and carried, and the meeting adjourned.

WAYSIDE MEMORANDA OF AN ARCHITECT DURING A TOUR IN IRELAND, MORE ESPECIALLY WITH REFERENCE TO SOME OF ITS ANCIENT REMAINS.

By THOMAS L. DONALDSON, Hon. Sec. F.C.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, April 26, 1858.

I WAS commissioned by the Government, in the autumn of 1855, to proceed, with J. Wilkes, Esq. and Spencer Shelly, Esq., to examine into certain allegations respecting the Lunatic Asylums then recently built in Ireland, and to report thereon. During the intervals of application to more serious and responsible duties, it was impossible for me, as an architect, to pass by numerous curious remains of antiquity in a country so little known to us upon that point. I could not avoid observing many peculiarities of taste and execution, which seemed to me worthy of more minute attention than I was enabled to give, for I could only bestow an occasional spare hour or two, where days could have been well spent.

My remarks therefore will be necessarily of a general nature; but this will be of less importance, as the paper by Mr. Blake on Kilconnell Abbey, and that by Mr. Cordon Hills on the Round Towers, recently read, have anticipated some remarks on those subjects I might have made, but which are now rendered unnecessary by their more complete researches.

The first important city north of Dublin is Drogheda. Many associations, historical as well as natural, give great interest to the name, as one of the leading seaports on the eastern coast of Ireland. It occupies both sides of the rising banks of the Boyne, here spanned by the stupendous railway viaduct, which rises 90 feet above high-water level. The centre opening has 250 feet clear water-way, and there are two of 125 feet span and fifteen of 61 feet span, leaving clear openings of 1,450 feet, independantly of the piers. The view from the south end, as the traveller stands at so elevated a point above the water-level, embraces the whole course of the Boyne down to the sea, bounded on each side by woody banks, while to the west the eye turns upon a fine expanse of country, reaching to the scene of King James II's defeat by King William.

There are several mediæval remains in the town, the most perfect of which, St. Lawrence's Gate, to the north, is a majestic mass, consisting of two fine circular towers, with a square space between the two about two-thirds as wide as one of the towers, and in which is the gateway. There is not a single horizontal moulding from bottom to top; they rise straight from the ground to the summit, where there are embrasures, divided by stepped parapets. There are several slit openings for light and air, and four or five larger apertures, possibly of later times. The face towards the country presents only the towers and the simple square space between; but towards the town the central part is recessed, with an arch over, and I think there must have been open galleries of communication between each floor of the two towers. The back part of the gateway inside is further protected by a projecting enclosure.

Another ruin, called Saunders' Gate, evidently the central tower of an old church, rises up with peculiar majesty. It is held in great veneration, so that the enclosure in which it stands is much used as a burial place by the Roman Catholics. This ruin presents a feature, one of a class prevalent in Ireland, and to which I shall have hereafter to refer, in a tower rising over the crypt of the church. A noble arch spans the central opening, which is flanked by solid masses of rough rubble construction. The square tower rests with majestic dignity on these piers, and rises two stories high,

with a projecting staircase at one of the angles. The windows of the two stories still retain their mullions and traceried heads, but the upper part of the parapets and embrasures are destroyed. A great knowledge of constructive skill is evinced in the present position of this tower, which stands firm on the dilapidated piers without any buttresses at the angles or from the masses beneath, to contribute to its stability. It is a striking fragment of bye-gone times, and speaks of a noble church, that once covered the area, perhaps with monastic buildings attached and the residence of a religious fraternity. It is now surrounded by wretched hovels, and the very grave-yard, with all its holy associations, betokens desecration, neglect, and decay.

There are several other monastic remains in Drogheda, mixed up with commercial warehouses and used for ordinary purposes, which would doubtless yield much fruit to careful investigation. But my three or four hours, including a visit to King William's famous passage of the Boyne and a peep at the pillar erected to commemorate his victory, did not allow me to take other sketches in this town.

Between Drogheda and the Giant's Causeway the tourist passes through Belfast, which has now many fine commercial buildings rising up, mostly due to the skill and taste of Mr. Lanyon, who, as county surveyor, has formed hundreds of miles of the finest roads possessed by any country. The rocks of the district afford a very fine material for the purpose; but whether traversing bogs, passing along mountainous ridges, or skirting the shores of the Irish Sea, the roads are broad, solid, well protected, and presenting scenes of beauty and ever varying interest.

A solitary round-tower at Athlone was the only object of antiquity that crossed our path northwards; but in the absence of monuments of art, the majestic columnar groupings and rocky precipices of the Giant's Causeway made us feel that we stood in the centre of one of the most glorious temples of the Almighty's own creation. In fact, in the North of Ireland, where Scotland has sent her sons as settlers, so that the descendants outnumber the original inhabitants, the Presbyterian and utilitarian element has produced nothing of a monumental or architectural class. Among men, simple, unpretending, thrifty, and devoted to utilitarian objects, the art element has found no response in this part of Ireland. Even in Londonderry itself I did not find a single object worthy my pencil, and it was not till we got to Enniskillin that Irish antiquity and mediæval art began to indicate themselves.

Devenish Island, on Loch Erne, is famous for its lofty round-tower, which stands alone from a commanding height, and is seen from a great distance. Mr. Hills has already described this, and alluded, as well, to the ruins of religious buildings in its immediate vicinity.

As we pass down the stream from Enniskillin, which communicates between the upper and lower Loch Erne, we find on the left bank, at the opening of the latter, Portorra Castle, a regular fortified post of the middle ages. It consists of a square enclosure about 74 feet by 60 feet from out to out, with a circular tower about 15 feet outside diameter at each of the four angles. The chieftain's dwelling, which is of modest pretension and was two storeys in height, occupies one end between two of the towers, and has a depth from outside to outside of wall of some 22 feet. A curtain wall about 3 feet thick surrounds the three other sides of the court, with the entrance to the fort in the middle of the side facing the chieftain's quarters. The towers have an inner free space of 10 feet 3 inches diameter. They consisted of two or more floors, and thus afforded sufficient accommodation for a small garrison; but, in cases of emergency requiring a more numerous armed force, barracks and sheds could be run up inside the court, backing against the curtain walls.

I venture to break in upon the regular course of my route by at once, for the sake of comparison, describing Mallow Castle, which is on the main line of railroad to Cork. It is situated in a beautiful

domain of some extent, and on the summit of a rapidly-rising bank, on which the finest trees and shrubs grow with wild profusion. Above all this verdure rises the majestic mass of Mallow Castle, with its quaintly-placed angular turrets and its peculiarly-planned entrance tower. The body of the castle occupies a parallelogram, exclusive of the projecting tower, of about 91 feet by 37 feet, outside dimensions, the walls being from 4 feet 6 to 5 feet thick. The porch occupies the centre of the elevation, its face being bevelled, with the edge in the middle; and the doorway is on the return. There is a small inner lobby, with a fine room to the right and left, about 31 feet by 27 feet, and a long room in front, carried out so as to extend 21 feet beyond the back front, with a square projection, and again a bevelled face like the entrance porch, only more acute in plan. At each angle of the principal front is an hexagonal tower, placed diagonally, apparently for the purpose of more complete defence and command of the front, and in one of them is the staircase to the upper floors. The whole is now a ruin covered with ivy and other parasitical plants; the floors are gone, but there are traces of a basement-story.

It will be perceived that at one end the walls are continued on; but it is difficult to decide whether this may not be an addition subsequent to the original erection, as would seem to be indicated by the position of the tower. There are considerable traces of other additions, as also of outer fortified works, as though the castle had been in the centre of a court, and surrounded by an enclosure of fortifications. The date of the castle seems to correspond with our Edwardian period.

The village of Mallow has a fine mineral spring, and is consequently one of the inland watering places of the south. A fine bridge has recently been completed over the river Blackwater, which is a stream of some reputation.

I will now also allude to Dunluc Castle, about five or six miles west of the Giant's Causeway. It stands crowning a lofty rocky projection, which stretches out into the sea, and the communication with the main-land is by a one-arched bridgeway, now only 2 or 3 feet wide, and forming a hazardous approach to any traveller who has not a very steady head.

Wandering in Ireland brings us acquainted with a class of miserable hovels, even in important towns, which may occasionally be met with in out of the way spots in England or Scotland, and as an exception: but they painfully obtrude themselves upon the notice in large groups, particularly in the middle and southern parts of Ireland. I allude to the cabins of the peasantry and lower orders. They are one storey high; the walling sometimes consists of some large blocks of stone at the quoins and doorway, and the rest built of smaller rough pieces. The roof is of thatch, enriched by a profuse vegetation of all sorts of weeds and plants. In most a chimney rises through the roof, but frequently a mere aperture is left in the thatch, lined by small pieces of board, and through that the smoke pours from the peat fire within. The whole is most rudely put together, the only care being to keep out the cold. The smallest window, with the greater portion of that blocked up and only admitting light through a square or two of glass; the mere earth as a floor, and with the slightest separation to divide one part from the other. A dung-heap in one part, and a reeking pool at the door; the ass, the pigs, father, mother, and children lead a happy life in common, mixed up with dirt and smells anything but fragrant to the casual visitor. And ah! how often did we find rows of such wretched hovels unroofed and dismantled, perhaps a lonely one remaining, inhabited by some sturdy obstinate occupant: all around desolation and ruin, but still his own, a desirable home, if it kept out the wind and rain. How strange did it seem, to find associated with such misery and privation the gay, good-humoured and witty peasant, ever ready with his joke and to indulge in a piece of frolic and fun.

Killmallock is about sixteen miles from the busy and opulent commercial town of Limerick, and was formerly a town of still greater note; so much so, that letters directed to its rival were formerly

directed Limerick, near Killmallock. Here are the ruins of city walls, mansions, towers, churches and monastic establishments; it was walled in, and the walls, of considerable thickness, rising 5 or 6 feet above the ground, can be traced for a great length. One of the entrances, called the Blossoms Street Gate, still remains well preserved, as shown in the illustration. The High Street contains numerous important mansions of wrought stone, rising up majestically with lofty fronts, the tracery remaining in some of the window openings, their gable-ends towering above the adjoining modern erections. Their noble fire-places, of bold and striking proportions, peculiarly designed, and of a character prevalent in Irish architecture of about the Elizabethan period or a little earlier, remain undisturbed in their original positions. The joints of the strings along the front are protected by a curious and ingenious hood moulding. Killmallock has a greater share of magnificence, even in this miserable state, than any town in Ireland, and a learned and ingenious writer particularly calls it the Béalbeo of Ireland. The inquisition of the Chief Remembrancer, 11th August, 29 Eliz. (Archdall, p. 810) finds "that there had been an abbey or religious house in Killmallock, known by the name of Flacispaghe, on which a stone house was erected, and which house, with an orchard or garden belonging thereto, was found of the annual value of 6s. and 8d. sterling.

We may suppose this to be the church and monastic building illustrated on the drawings. It corresponds in arrangement and general disposition with Kilconnel Abbey, described on a previous evening by Mr. Jas. Blake. The church consists of a nave, tower, chapel and choir; the tower in its usual place, crowning the intersection between those principal features, upheld, like that of Drogheda, between stone piers, and rising several storeys above the roof, and thus forming from without a prominent and lofty object. Immediately adjoining and on the north side, are the cloisters and dwellings of the monks. There is the kitchen building, with its kitchen and other dependances, and the refectory immediately adjoining, with its vaulted ceiling; above which is a large hall or dormitory. Attached to the choir is probably a vestiary, in the space indicated on the plan. The effect of the choir, with its numerous windows with lancet heads, must have been very fine. There are numerous recesses in the walls, as for tombs, and the whole displays a considerable degree of past magnificence, and some of the windows are very gracefully composed. The perspective view shews the general state of the building.

Killmallock Church is still partly used as a place of Protestant worship. At the north-west angle is a circular bell-tower, by many, and by Mr. Gordon Hills, supposed to be one of the ancient round-towers. But to me it conveyed a different impression. The circular strings of mouldings and the rapidity of the diminution makes it, in my mind, belong to the common class of circular belfry towers, like that of Hadspoe Church, Essex, shewn in Cotman's engraving. It evidently had had no roof, for the embrasures still exist. But perhaps the most valuable portion of this church for our purpose is the parapet and roof of the south side aisle, which explain the peculiar mode in which the ancient Irish architects carried off the waters from the roof. The parapet was crenellated. Immediately abutting against the parapet were hollowed slabs of stone, the sides of which rose up like the tiles of the Greek temples. These tile slabs were 1 foot 10 wide, and 6 inches apart. The space between the two was covered by a hood-tile, the sides of which fitted with the sides of the tiles, and thus threw the water into the centre of the latter, as in the Greek temples. Thus the waters were discharged directly outside through square holes cut through the parapet. The rest of the roof is formed with the usual slating slabs, in the ordinary way. The coincidence between this arrangement and that of the Greeks is remarkable.

Another illustration of arrangement peculiar to the Irish exists in a square church tower. The parapets are crenellated and stepped, as usual in them. Inside the parapet the roof rises with a

pitch; but instead of abutting against the parapet, there is a flight of steps up one side of the roof and down the other at the ends, affording easy communication, and the opportunity of using the embrasures with effect and safety.

From Kilmallock I proceeded, after a four hours' stay and sketching, to Gould's Cross; and although Holy Cross with its rare and curious remains was so near, I was obliged to forbear visiting it, as the daylight was receding, and I had a six miles' drive, ere I could reach my home for the night at Cashel, in Tipperary, which gives the name to the bishopric. And never shall I forget the agreeable ride that I had in one of Bianconi's cars through a most pleasant country, and the cheerful companion of a driver pushing on as rapidly as we could to reach this venerable place in the twilight, at least, ere the sun had completely set behind the hills. For a half-dozen miles off one can see a conical hill rise out of the general surface, crowned by buildings, with gable-ended walls and a round tower, recalling in many of its features Mount Cassel, near S. Omer, in France. As we approached, the evening grew darker and darker, and the sacred mount, as a black mass, displayed its features distinctly in outline, with a glowing setting sun as a back-ground.

The next morning I rose with the sun, and from the town directed my steps to the summit of the hill, on which stands the cathedral, dedicated to St. Patrick, with a castle attached to it at the West end, a round tower near the N. E. angle of the North transept, and on the South side, the Norman chapel, called that of Cormac, who was killed in battle in 908. It is possible that there may have been here an earlier chapel than the present one, founded by Cormac or in honor of him, subsequently replaced by this more elaborately-enriched Norman building, as the date is too early for the existing one. The whole of these buildings were enclosed by fortified walls, with towers all round, which have now disappeared; but there still remains, near the entrance to the sacred precinct, the vicar's coral hall. The greater portion of the cathedral seems to be of the 13th and 14th centuries, but some parts are later, as also the castle, which contains two remarkable chimney pieces. The mantel of both consists of a flat arch, the stones keyed into each other. One has a hood, which causes a projection to the flat arched mantel, one end of which shuts against a wall; but in order to resist the thrust at the other end, which projects, there is an horizontal buttress acting as an abutment.

Some idea may be formed of the importance of this sacred foundation, when, from this elevated position, one can see five ecclesiastical establishments, once connected with it as so many dependencies, and giving dignity and power to the rock-built cathedral towering above. Within a short distance, occupying favored spots all around, are St. John the Baptist's Parish Church, Hoare Abbey, the Dominican Abbey, the Roman Catholic Chapel on the site of the Franciscan Abbey, St. Nicolas' Abbey, and St. Mary's Abbey; which would doubtless afford a rich harvest of discovery to any one, who had the time and necessary intelligence to do justice to such important subjects of study.

Kilkenny is a town of great importance on account of its striking antiquities, and even of its modern buildings. The Castle, the majestic seat of the Ormond family; the Cathedral of S. Canice, with its round tower; Black Abbey; the modern Roman Catholic Cathedral, which rises with overpowering grandeur above the general line of buildings, and the Lunatic Asylum, are only a few of the many remarkable edifices, ancient and modern, that deserve the attention of the traveller and the artist. The tower of Black Abbey crowns the intersection of the nave and transepts, and is a fine illustration of the fortified arrangements of even the sacred buildings of early Irish history. The four angular turrets are square, and have their parapets crenelated with square pinnacles at the angle, rising above the general level, the whole group forming a turreted turret at each angle of the main tower. The main parapet of the centre has an embrasure in the middle, and on each side the parapet

is stepped, and the whole has a slight projection from the general surface of the tower, as low down as what may be presumed the flat of the tower. In like manner the parapets of the clerestory walls of the nave are crenelated and stepped, forming an overhanging parapet, supported on corbels, and perforated at small intervals, so as to allow the immediate discharge of the waters from the roof without any gutter parallel with the parapet, as at Killmallock. The inside of the church has many antique memorials, and on the outside near the entrance porch are some fine simple stone coffin heads, carved in relief or with sunk lines, as shewn in the illustrations, of croziers, shields, &c., and one with the mere head of the deceased in high relief. They are of the black marble of the county.

The Round Tower, within 6 feet of the south end of the south transept, rises to a height of 95 feet 8 inches from the ground to the moulding of the first course of the conical roof, which still remains and gives the inclination or pitch. The lower diameter from out to out equals 14 feet 9 inches, the walls being 3 feet 8 inches thick. The upper diameter from out to out is 11 feet 7 inches, with walls 2 feet 8 inches thick, and six square window openings, 1 ft. 5 wide and 3 ft. high. The diminution in the thickness of the wall is gained by offsets inside, apparently arranged to suit floors at certain heights. The door is at the height of 9 feet 4 inches from the ground, 2 feet wide, and 4 feet 9 inches high, with a circular head. In the height of the tower there are four small apertures for windows. There is a very convenient access up to the top, with steps and landings, and thus the traveller can with rare facility ascertain the full particulars of this fine erection of remote antiquity.

The last antiquities I visited in Ireland were those of Glandelough in the County of Wicklow, commonly called the Seven Churches. This is a term given also to other sites in Ireland, as to Clonmacnois on the Shannon, which has two round towers. Glandelough is one of the wildest possible spots, near a lake about two miles long, surrounded by granite and limestone ranges of mountains, and apparently shut out from the rest of the world. The cluster of churches would more appropriately be called seven chapels, for they vary from 30 to 40 or 50 feet long, and are altogether humble in their pretensions, yet still possessing much interest. S. Kevin is the peculiar saint of the spot, and his cathedral, as it is called, and the other edifices are constructed of rude masses of stone, roughly squared for the quoins and openings and interspersed with a species of lighter rubble construction. The doorways have a flat lintel, surmounted by a rough discharging arch, as shewn. Near the cathedral is a lofty round tower, without a roof. The masonry consists generally of average courses, 6 inches high, with some larger blocks irregular in form. At the bottom of the tower is a higher projecting course, answering for a plinth. The doorway is some 10 or 11 feet above the surface of the ground, about 2 feet wide, formed with large blocks of stone, with one of considerable dimension over the opening, hollowed out, so as to give a circular head to the aperture. The upper windows have a square head.

The most perfect and best preserved building of the group is the chapel or church, popularly called S. Kevin's Kitchen, on account of the small circular bell turret, which crowns the apex of the western gable, and is taken by the peasantry for a chimney. This turret has a conical roof and four square window openings immediately beneath. The roof is covered with slate stone, and is of a high pitch, having beneath it a vaulted ceiling, there being a chamber or hollow space between the two reported to be the sleeping place of the monks or priests. The construction is like that already described, but the lintel has a rude projecting slip on the face, as though it had been moulded. The joints of the string above it are rebated, evincing some care in the putting together of the rude construction.

Ere I close these imperfect notices, permit me to mention one of the richest specimens of domestic Gothic that I met with in my rambles. It is the door and window of an old house in

Galway, one of several rich memorials of bygone times, when Spain had considerable commercial relations with this port. Even the dress now worn by women of the lower class is peculiar, and consists of a black cloak and red petticoat, supposed to date from the Spanish period. The style of the sketch before you, with its three-centred arch, heavy hood mouldings, with the flowers, bespeak the style of the rich Spanish or Flemish art. But there is a peculiarity in the return of the hood moulding at the knee, above which rises a pyramidal weathering, found in other parts of Ireland and in the sketch of the doorway at Killmallock, which is also very peculiar.

In Ireland there are no edifices of the Mediaeval period that can compare in extent with the first class edifices that we have in England; none that possess such a high standard of art, or such a variety, richness, and fulness of pure details. Some have been sadly treated in recent times, particularly S. Patrick's Cathedral, Dublin, which has been restored in a style disgraceful to its promoters. The late Mr. Cottingham has very successfully and ably carried out the restoration of Armagh Cathedral, and fitted up the interior in a manner conformable to English precedent in a very able manner. There are many Roman Catholic cathedrals of very large size being now erected and on point of completion, important as to extent and general disposition, but the details and style of which leave much to desire. The most successful modern edifice in Dublin, without doubt, is the addition made to Trinity College of the new museum by Sir Thos. Deane, Woodward, and Deane.

And now a few words on the scenery near Dublin. None on earth are more favored by nature than the inhabitants of Dublin. After the business cares of the day they may find within an hour, or at most two hours' ride or drive, their sea-side home at Kingstown, Bray, or along the coast to Wicklow, on rock or sandy shore. They may have their cottage or villa on the banks of the Dargle, or amid the sylvan solitudes of Powerscourt or Avondale;

"That vale in whose bosom the bright waters meet,"

and possess the richest scenery, and most lovely views of hill and dale, and fertile meads. Or if lovers of savage scenes, they may plunge into the rocky defiles of the Scalp, amid the chaotic mountain masses scattered in wild confusion; or may wander among the mountains, which encircle Glendalough, and in its wildest passes with countless legends of past centuries, and in the presence of its ruined structures, once held in deepest veneration, they may enjoy a romance, an abstraction and delight, which it would be difficult, if not impossible, to find near any other capital in the world.

Such are a few of the results of the spare hours of a three weeks' hurried tour in the sister isle; devoted mainly to more important and absorbing duties; but which found a relief, and in fact gained tone to the mind, by an occasional study of the beauties of nature, the romance, the history, and antiquities of old Ireland.

Mr. GORDON HILLS, Associate, thought there was some foundation for the opinion that the room over the vaulted roof of St. Kevin's Chapel had been the dormitory of the monk (which was the firm belief of the peasantry); because there was a similar croft over the vaulted roof of the small chapel at Cashel, with a fireplace at the west end; the room, like the chapel itself, having a pointed arched roof. He agreed with Mr. Donaldson, that Cormac's chapel, Cashel, was of later date than the time of the particular Cormac to whom it was ascribed (908), and that it was, in fact, erected by another Cormac, who died in the year 1134. In the roof of St. Kevin's Chapel the stones were laid horizontally in parallel courses, with a stone covering over them. At Cashel the roof was very carefully constructed of a light tufa, with an outer coating of sandstone. St. Kevin's Chapel was only 25 feet long, and the width of the interior was about 18 feet.

Mr. DONALDSON stated that some of these chapels were not more than 15 feet in length.

Mr. HILLS said that the church of Glendalough was 75 feet, including the chancel, which was of later date. Its original length had been 50 feet.

THE CHAIRMAN, Mr. ASHFITEL, Fellow, observed that Mr. Hills had used the word "croft" in a sense which appeared to throw some light upon the meaning of the word "*undercroft*," applied in England to a crypt;—the vaulted space above being the "*croft*," and that below the church the "*undercroft*."

Mr. HILLS said he had used the word as commonly applied by antiquaries in Ireland. A croft appeared to mean an elevated place,—as a small field lying in an elevated position.

In answer to an inquiry whether there was any external chimney or turret to the fire-place in the chapel at Cashel,

Mr. HILLS said that none now remained. At Kells, however, there was a building of precisely the same construction, and from the marks remaining on it, there could be no doubt it had been inhabited. Dr. Petrie considered these chapels to have been oratories, and that the crofts were occupied by ecclesiastics.

THE CHAIRMAN inquired if Mr. Hills had taken the contour of the mouldings. He believed the result of almost all archaeological investigation shewed that the mouldings constituted the comparative anatomy of architecture, and that the character of a building could be judged by its mouldings, just as the structure of an animal was restored by Cuvier from a single bone.

Mr. HILLS concurred. The varieties of mouldings were the very alphabet of the art. He had taken the sections of some of the mouldings of these Irish chapels, but had not any immediately at hand.

THE CHAIRMAN asked if there were any cusps in the tracery of the windows. It appeared to him that the tracery presented all the elements of elaborate variety, without the cusping.

Mr. HILLS said that the mouldings resembled those of the English Perpendicular period more than any other.

Mr. DONALDSON observed that these buildings were constructed of the black marble of the country, which was difficult to work; and that economy had no doubt had great influence on the degree of ornament introduced.

Mr. HILLS fully agreed in this opinion. Carving was consequently very rare in the smaller Irish churches. At Kilmacdure, however, in Galway, the decoration, which was Romanesque in style, was most admirably and richly wrought.

Mr. GODWIN, Fellow, hoped the practical result would grow out of the present discussion, of increased attention being paid to the preservation of these interesting monuments. When he visited the Seven Churches, three or four years ago, he found they had been exceedingly ill-treated. There were many early grave-stones around them, with crosses and other decorations, for which very little care had been manifested; but he hoped the mention of this discussion in the Irish newspapers would show that the English public were alive to the merits of these relics of antiquity.

Mr. HANSARD, Associate, adverted to the arrangement in some of the old buildings in Galway, in which a small lattice window was seen at the side of a large doorway; with other peculiarities evincing a Spanish origin; and asked whether there was anything in the character of the buildings to show that they were derived from Spain.

Mr. DONALDSON said that the town of Galway presented many curious features worthy of study. The style was evidently a foreign importation, and very different from the Mediæval architecture of England. It resembled the Spanish, or, perhaps, more closely the Flemish style.

Mr. M. D. WYATT, H.S., said it would be interesting if Mr. Donaldson or Mr. Hills could give any particulars as to the actual designers of these Irish churches. It appeared to him that these monu-

ments might be divided into two classes. First, those he believed to have been erected from the native design which prevailed in comparative purity as late as 1200, and retained the characteristics of the style generally known as Celtic, with some affinity to the Scandinavian, but distinct from the Norman style displayed in Cormac's chapel. This chapel differed from that of Timahoe and other Irish structures, and was not in the style of the richly-decorated ancient crosses, in some of which was carved a prayer for the chieftain, and sometimes for the workman who made it—the names of both being unquestionably Irish. It was very desirable to know under what circumstances foreign elements of style had been introduced; and as Cormac's chapel was one of the earliest, it would be exceedingly interesting to know who designed this building for that chieftain. It appeared that there were two chieftains of that name in the locality; one of whom died in 908, and the other, according to Dr. Petrie, in 1134; so it was very possible that the chapel might have been built in the time of the second. It was evident, from dated documents and monuments, that, at the time thus assigned to Cormac's chapel, there were architects in Ireland capable of executing works quite equal in elaboration to anything which it displayed. That the same degree of skill was possessed at the same time by the workers in metal, was evident from remains in the Museum of the Royal Irish Academy. Nothing could be more refined or elegant than the decoration of those objects. Nevertheless, after about 1150, the Irish churches and other monuments, in their general features, as well as in their mouldings, appeared to resemble closely the English buildings of the same period. Allowance should be made for the introduction of the monastic system, which had become common to the whole of Europe, and it would be natural that the architecture of Ireland, from its vicinity to England, should partake of an English character. The question as to the actual designers of these works appeared to him to be the great *crux* in Irish architectural antiquities; any information on that head would therefore be very interesting and valuable.

MR. GORDON HILLS was strongly of opinion, from the contour of the mouldings, that Cormac's chapel was the work of Irish architects. They were entirely different from English mouldings. The cathedral of St. Patrick, Cashel, was erected about 60 years after Cormac's chapel (about 1152), by De Montmorency, one of the followers of Strongbow; and although it had some English, it also presented Irish features in the battlemented towers, and the peculiar gutter openings which had been referred to, shewing that Irish architects had been employed, and that their style had influenced that of the English workmen. In Kilmallock, founded in 1291, the mouldings, &c. were decidedly not English. The church at Adare, built about 1400, was also very Irish in its character. Upon the whole he was inclined to think that the architects of these buildings were natives of Ireland, and very little indebted to foreign interference. The church at Holy Cross was not like the Early English churches, but was quite peculiar in its style, and magnificently rich in its details. It had an elaborate vaulted roof to the chancel, with very beautiful small twisted columns; resembling in some respects those of Roslyn Abbey, Scotland, but more highly finished.

MR. M. D. WYATT remarked that the principal features alluded to by Mr. Hills were mainly structural, and therefore gave little evidence of style. They arose from the necessities of the country; and it was not to them, but to minor details, in designing which the architect was free from such necessities, that they should look for evidence. He was inclined to think that after 1150 Irish architecture gradually changed from what it had previously been; and that different notions from those which had been at work before the invasion of Strongbow, then influenced the art of the country.

In reply to a question, MR. HILLS explained that Cormac's chapel was anterior in date to the cathedral, which had been built against it, but on a different axis; and that the round-tower was older than the chapel.

THE CHAIRMAN suggested that this variety of position might bear upon the question of orientation; a very interesting point, which, however, did not appear to have been observed in the sacred buildings of Rome and Jerusalem. With regard to the Castle attached to the Cathedral, and to the other Irish castles,—they did not appear to have any analogy with the English castles of the Norman period; but they rather resembled those of the Edwardian era. The large unoccupied space within the outer walls shewn in the plan of Porterra Castle, appeared to him to require explanation.

MR. DONALDSON said the round-towers at the four angles contained lodgings for the defenders, and also defended the side-walls of the large enclosed space which would receive cattle for protection at night. In case of a prolonged siege, temporary barracks were probably built as a "lean-to" against the walls of the court. These walls were only 5 or 6 feet high, and there were no visible evidence of any walls or buildings having occupied the area of the court. The internal diameter of the towers—10 feet 3 inches at the angles, only 15 feet externally—would nevertheless suffice for the accommodation of the forty or fifty men required to defend the place.

MR. KERR, Fellow, and MR. M. DIOBY WYATT, made some further remarks on the changes of style in the architecture of Ireland; the latter gentleman expressing his opinion that Cormac's chapel was of Norman origin, as shewn by the chevron moulding, the capitals, and other features of that style; and that the chieftain by whom it was erected had probably employed an architect who had worked either in Normandy or England.

MR. KERR suggested that the influence of the Church in Ireland might have been lessened after the decay of the first style, and revived in the twelfth century by the introduction of the monastic system from England, which would account for the diversities and foreign features seen in those early specimens of Irish architecture.

MR. M. D. WYATT agreed with Mr. Kerr to a certain extent; but the ancient Irish Church held different tenets from those of the ancient Roman Catholic Church, as was particularly shewn in the tonsure of the priests; which altogether differed from that of the Norman priests. The Irish were greatly emancipated from the usual dogmas of Rome. The Irish and English systems were altogether different. After the time of Strongbow an importation of Roman ecclesiastics took place, who brought with them the usages of the Church of Rome, and thence arose a rude imitation of English Gothic architecture. In different reigns of English sovereigns it was known that foreigners of various nations were predominant in matters of Art. Thus, in the reign of Henry III. the majority of ecclesiastics were Italians. In the reign of Henry II. there were an immense number of French ecclesiastics in England, and in each of these different periods the architecture partook of the masonic style of those respective nations.

THE CHAIRMAN said that the difference in rule of the various monastic orders went far to explain the peculiarities of their different structures. The Benedictines lavished as much as they could on decoration, while the Cistercians, on the contrary, repudiated all ornament. Buildings of the same age were therefore not to be ascribed to different periods in consequence of the presence or of the absence of decoration.

MR. DONALDSON observed, that as in England we had a number of interesting buildings which might be Saxon or Danish, but which he thought should be simply described as "*pre-Norman*," so in Ireland there was a style of great antiquity to which it was difficult to assign any fixed date. He hoped that the interesting discussion which his Paper had called forth would incite the natives of Ireland to examine more minutely their national antiquities, and do more justice to them than he had been able to do himself.

The vote of thanks having been carried, the Meeting adjourned.

ON PUBLIC COMPETITIONS FOR ARCHITECTURAL DESIGNS.

By GEORGE MORGAN, Fellow.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, May 17, 1858.

IN diverting the attention of the Institute and the profession to public competitions for architectural designs, I am actuated more by a desire to promote a calm consideration and discussion of this important subject at this opportune period, than by any confidence in my own powers to treat it with any novelty, or to grapple successfully with all, or any, of its difficulties and abuses. I am unwilling that the present session should glide by without an endeavour, on the part of the profession, to establish a system of public competition on a more satisfactory basis. Recent events have made vividly manifest the injustice, disappointment and loss which the present system entails on architects, and have enlisted such an amount of sympathy, on the part of the public and the press, as to render facile any well-directed attempt to reform it. I could have wished that some more able and experienced member of the Institute had resuscitated this subject, but I trust that any deficiencies on my part may be atoned for by the good that must result to art, the public and the profession, if, through my humble endeavour, architects will resolutely determine to settle the terms upon which they will enter into public competition. So grave a matter may well be approached by any one with great diffidence, when it is remembered that (in 1838), nearly twenty years ago, a committee was appointed by this Institute to consider my subject, who, having thoroughly investigated it, seemed appalled by its difficulties, and concluded by publishing a report containing much valuable information, but leaving the remedy very much where it was before, in the hands of the profession.

Save a most laudable attempt, in the year 1850, by the Architectural Association, and the publication of a report by that body, containing a code of regulations, no other combined movement has, I believe, been made to carry out the suggestions of the committee of 1838. From time to time, and recently with the greatest force, the Council of this Institute has urged upon the profession the recommendation of the committee of 1838, "that architects should meet together and lay down a set of regulations as to on what terms they ought to furnish designs in competitions." Our professional press have always endeavoured to arouse that section of our profession who treat the whole subject with apathy or indifference, to its importance, and to make manifest to the other the suicidal policy of rushing indiscriminately into public competition. To show the extent of public competition amongst us, and its application to the most trivial objects, I have searched, and find that during the last year, 1857 (a year of great depression generally, but especially in building matters), invitations were issued for sixty-nine public competitions for designs for buildings, representing, at a rough estimate, £300,000., the premiums ranging from 21s. to £200.; and in the majority of instances the conditions gave notice that the employment of the successful architect was very doubtful. It is impossible to form an accurate estimate of the cost of the preparation of the designs submitted in response, but most probably £30,000. would not be an excessive estimate representing the prime cost of the production of the designs and the professional value of the services in the carrying out of the buildings. Here, then, is an annual loss to the profession of £15,000., assuming the very doubtful proposition that the full commission of 5 per cent. is received by the successful competitors.

In reference to the general principle of competition, the conclusion is evident that it dates from and exists the moment that two or more individuals seek a common object. It is fostered by the aspirants, and springs from them: it therefore rests with them to determine the terms on which they will strive. It cannot be imagined for one instant that our profession can escape the action of this general principle, and, consequently, competitions amongst us must exist, and the terms of competition rest with ourselves. In what form can it exist most conducive to the advancement of art, the progress of science, and the welfare of the public and the profession? If competition is to be only that of interest, or canvassing for commissions, how degrading is the position of the architect; and in such a strife the most talented artist has probably the least chance.

If competition is to be select or limited, it must partake also, in some measure, of favouritism, canvassing, &c., and the advance of our art will be proportionately impeded. A competition of merit can alone exist amongst artists, if any regard be paid to the prosperity of art. Employment ought not to be sought, it ought to be commanded by artists. Public competition, then, appears in principle to be the system most likely to produce the desired objects. To substantiate this conclusion, I will not cite the many admirable buildings that competition, with all its corruption, has given us, for I admit that the name is legion of those buildings diametrically the reverse in character, and yet the offspring of the same system. But I endeavour to substantiate it by the increased study and knowledge of architecture, and by its progress as a fine art amongst architects during the term that public competition, in its abused form, has increased amongst us. I attribute the revival of Gothic and Italian architecture, and the rapidity of the progress of such revival, mainly to public competition. I attribute the establishment of the Architectural Exhibition to public competition. I attribute the accession of many noted names as architects, and the great increase in the number of members and importance of the profession, to public competition. I attribute a great diffusion of architectural knowledge amongst the people to public competition; and, perhaps, progress in art depends more upon the state of education of the public than upon that of the professors themselves. If the client be an artist, the architect cannot fail to be so.

Let me first consider the evils which are inseparable from public competition for designs in art. A proposal for public competition may be divided into four sections:—the instructions, the terms, the regulations, and the award. It is obvious that the public must draw the instructions and make the award: it ought to be equally clear that the artists should settle the terms of remuneration and the regulations amongst themselves, so that each competition design is equitably represented, and that the successful artists be not deprived of their reward. Now, the evils which are inseparable from all art competitions, are as to the instructions,—

The imperfection or vagueness of instructions.

The want of direct communication and consultation between artist and the client.

As to the award,—

Injustice on account of incompetency or fickleness of the judges.

The above evils are inseparable from competition, mainly, from the ignorance of the public on all matters connected with art, but almost hopelessly irremediable as regards our profession. A general knowledge of painting or sculpture is much more easily attained than of architecture; and yet no one would pretend to act, in a competition of painters or sculptors, without some pretensions or qualifications of fitness for the office. There are many highly-educated amateurs, competent to decide on the merits of a work of art in painting or sculpture. But in respect to our neglected art, how different is the case! The public invite architectural designs, and adjudicate upon them without the slightest capability for so important a duty or knowledge of the subject. The unavoidable evils

to which I have alluded are therefore magnified, and, in an increased degree, beset architectural competition.

The evils to which our profession are more subject in competition are the endless waste of thought, energy, and time, and loss which are suffered by the unsuccessful competitors. Public competition seldom calls on the energies and pocket of the painter and sculptor, and the fruits of their labours are never entirely lost. The painter's cartoon or the sculptor's model, although unsuccessful in competition, may secure him patrons and clients, and if vivified by genius, will certainly command a reward on the consummation of the work. Again, the painter or sculptor can enter into competition without any study foreign to his art or preparatory loss of time. How different is the lot of the unsuccessful architect! He has to study instructions, incur journeys, and collect his materials, before he can enter into competition. Let me take an example from the late competition for barracks. His first labour was to master the contents of the elaborate report. This entailed an inquiry into the construction of a battalion, the manners and habits of soldiers, sergeants, officers, and all the minutiae of military life. If he competed for the cavalry barracks he had to study stables, riding-schools, forges, &c., granaries, hay-lofts, and all matters relating to troop horses. He had to incur outlay in travelling to inspect barracks in various parts of the kingdom, and he had to turn his attention to barrack-rooms, canteens, libraries, schools, hospital, orderly-rooms, guard-rooms, ablution-rooms, bakery, provost prison, powder magazine, wash-houses and drying-rooms; to ventilation, warming, supply of water, cooking apparatus, and engineering details, under special circumstances; formation of parade grounds, racket courts, &c. &c. &c., and numerous other matters to which perhaps he may never turn his attention again, with but small opportunity for the only study from which he could derive any permanent benefit as an artist, that of the fine art of his profession.

It is really lamentable to consider the waste of time, thought and money expended on this almost gigantic task without any profitable result. It is evident that, in the majority of competitions, the position of the unsuccessful architect assimilates in a greater or less degree to that in my example. His progress as an artist is impeded by unprofitable pursuits and by the vast ramifications of the studies into which he must enter. In contrast to him his brother artists, the painter and sculptor, even in competition, are perfecting themselves in their arts, and expending their time and energy to some profitable result. I can hardly consider but that, if the public be made fully aware of the unrequited labour which the profession bestow on the preparation of designs for public competition, that even the successful are never fully repaid, many of the abuses which now encompass the system will be cheerfully remedied. The most prominent of these abuses are its too general application, its application to favouritism, or for mere commercial purposes; and, again, when there is no positive intention to erect the building for which the competition is invited. To revert to my subdivision of the component parts of a proposal to compete:—

I. I may classify among some of the abuses of the "Instructions,"

I. The avoiding of any definite instructions.

II. The naming of an estimated sum for which it is impossible to complete the building with all its requirements.

III. The suggesting of requirements which are not really wanted, and which often lead astray the competitors. Instance,—the Government Offices competition, and the schemes which were submitted through the allusion to the communications of the metropolis.

2. The abuses of the terms are:—

I. Offering inadequate remuneration.

II. The hollow speciousness with which they are often drawn, to excite the too willing belief

of the aspirant that the only real prize for which an architect competes—that of the carrying out of his design—shall be awarded to him, if he be successful. Ostensibly the terms promise this, but they are encumbered with provisos,—“if his character be unexceptionable”—“if he be competent”—“all things being equal”—“he shall have the preference,” &c. &c., which the too credulous competitor never thinks can apply to him.

III. Architects under the present system being always ready to respond to any terms: however absurd, we have public bodies, through their clerk (generally a solicitor), drawing terms more and more onerous, introducing some additional hardship on the profession, and reducing the remuneration on every fresh appeal.

IV. A competition of terms. In two or three instances lately, the competition has been simply one of terms. I may notice the memorable one of Bolton Workhouse, in order to ask the Institute if the majority of these men are to be considered architects by the public, or will the Institute take some steps to point out the difference.

3. The abuses of the regulations, I think, rest principally with the profession. They may be enumerated:—

I. Wilful attempts to gain advantage by exceeding or departing from the regulations.

II. False perspective drawings.

III. Inaccurate estimates.

IV. The discovery to the judges of the ownership of drawings when a competition is under consideration.

V. Canvassing the judges.

4. The abuses of the award are—

I. The ignoring of their own instructions by the judges.

II. An unjust award, either through favouritism or from a determination to adjudicate, to escape from the difficulties which the unfortunate judges have at last discovered.

III. The selection of designs without testing the estimates or representations of competitors.

IV. An award solely on commercial grounds, as if the designs were mere tenders.

V. The adjudicating secretly or politically.

VI. The want of any remedy to architects.

It is not necessary for me to occupy the time of this meeting by citing examples in detail to prove the abuses which I have enumerated. All of us know practically that these, and many other abuses which I have failed to specify, exist, and that there is no probability of their diminution, but that they will rather increase and multiply unless the profession make some effort to remedy them. But the greatest of all abuses, and one which I cannot pass by without some further remark, is the most prevalent and rather recent abuse of the depriving the successful architect of the fruit of his exertions—the realization of his design. I have endeavoured to sketch the position of the unsuccessful architect; but the position of a successful architect deprived of his reward is a disgrace to the profession.

Many have experienced the bitter lessons of disappointment, but still have struggled on, time after time, with the same heartick result, and only buoyed up with the hope of ultimate success. It is absolutely shameful that any system should exist which, through the apathy of his profession, deprives an artist, successful after such a struggle, of his just and hard-earned reward. That this system does exist, even amongst the guardian patrons of art, let me trace the history of the late Government offices competition. Suddenly we heard rumours of a grand scheme in contemplation by the Government for the concentration of all the widely spread offices of the various executive

departments. We watched with interest the proceedings. We read attentively the minutes of evidence taken before a Parliamentary Committee summoned to consider it, and rejoice at the unanimity of their report, in favour of the scheme. The First Commissioner of Works sought the counsel of the profession, and discussed with the members of this Institute the terms of a public competition for designs. Amongst others, a question was put as to the intention of Government in regard to employment of the successful architect, and was answered in the usually reserved official manner. But I quote the *Builder*, April 20th, 1856:—"Although no pledge would be given, it was understood that the successful competitors, if competent, would be employed to carry out their designs, and would receive the usual commission of 5 per cent."

As soon as the advertisement of the invitation appeared, many of us, if not all the profession, applied for copies, and we read—

"Office of Works, Whitehall, London,
"30th September, 1856.

The Commissioners of Her Majesty's Works and Public Buildings, give notice that they are prepared to receive three designs from architects of all countries; the first to comprise a scheme for the concentration of the principal Government offices on a site lying between Whitehall and the New Palace at Westminster; the other two designs for buildings which Her Majesty's Government have determined to erect forthwith as parts of such scheme—one for the Department of the Secretary of State for Foreign Affairs, and the other for the Secretary of State for War.

"If the architect to whom a premium may be awarded in respect of designs No. II. and III. or either of them, shall be employed to superintend the execution of the work, he will not be entitled to receive such premium, but he will be paid a commission, at the rate of five per cent. upon the outlay. Such commission to include all expenses for measuring, superintendence, &c., except the salaries to clerks of works."

The above particulars were forwarded to all the European embassies without one word of comment. Many of us responded to this invitation, and all of us are intimately acquainted with the proceedings down to the final award. Now, if the profession had been only true to itself, could there have been any doubt of the result, that the successful competitors would reap their reward? It is with regret we are compelled to admit that there has been an attempt to deprive them of it. Now, I am not going to prejudice the result of this case of public competition; I fervently hope that justice will be done to the successful competitors, and through them to the profession. I think that the case of the successful competitors is much stronger than it has yet been put before the Government, and I urge upon the profession to use every endeavour to obtain justice. This case appears to me the fittest for consideration upon the present occasion, as it exemplifies the interpretation by the highest public authority of the present system of public competition. By analysing this, in order to suggest, or arrive at, a remedy, I give the public the benefit of the most liberal interpretation of the view which is taken by them of their part of the contract, involved in public competition.

On first sight, the invitation to architects to compete for the new Government offices seems all that could be desired. We have instructions explicit and complete; terms ostensibly fair and consonant with the views of the profession; regulations drawn almost in accordance with the code prepared by the committee of the Architectural Association; and an award by irreproachable judges, assisted by professional assessors. Why, then, should there be any doubt about the result? Because we, the profession, tacitly assent to a limited responsibility on the part of the public. This is the crying evil in public competition. In private practice we are protected by the law of custom; in public competition we abrogate the law by our own acts in competing on whatever terms

the public dictate, trusting to the moral effect of custom upon the public. It will never be maintained that any member of the profession competes for the mere small money premium; then why permit the public to think that we do? Why do we respond to invitation after invitation, and accept the shadow for the substance in competition after competition without a murmur or complaint? What can be the result but what it is; and that when the Institute memorializes Lord John Manners on the Government competitions, the First Commissioner being ready with a precedent, it is implied that if the Government do not employ the successful competitors to erect the Government offices, they are not acting in any way contrary to custom or at variance with justice?

If we only enter into competition for the prize of executing our design, why do we not as honourable men state boldly and unreservedly that the first prize in any competition must, in the usual professional terms, be the professional employment?

There must be no proviso of competency, or age, or character on the part of the successful candidate. If the public resort to public competition they must share some of the evils with the profession, and not cast all the burden on the shoulders of those least able to bear it. We must fix upon them the responsibility of proper instructions, the voting a sufficient sum for the required accommodation, a thorough examination and publication of the designs, and the most just award in their power. We must make them aware of the responsibility that rests with them in every step of their progress, and urge them to seek the assistance of professional men, both in the preparation of their instructions, and in making their award. I consider they must be bound to make an award under any circumstances; for in ninety-nine cases out of a hundred, the excess of the cost of a design over the estimate rests with the public, as they stipulate for the requirements, and gratify their taste in the selection. If the public are wrong, why should the author of the selected design be only punished? It appears to me, then, that the great experiment of the Government offices competition fails (and all systems may be said to fail when there can be a doubt as to the results) solely from the limited responsibility assumed by Government. From this cause we have instructions hastily conceived and calculated to mislead the competitors, as they aimed at concentration, and we have an award evidently defeating the main object of the competition, the concentration of the Government offices. If Government did not interpret their invitation that they might put the profession to the expenditure of £25,000, awaken the rivalry of the whole profession, and deprive the successful competitors of their real reward at an outlay of £5,000, we should not have had instructions to aim at concentration, and an award of prizes to those who had simply contented themselves with designing separate buildings. Simply, then, the reform of the abuses of the instructions and award, as far as they can be reformed, except by the progress of art, rests with the profession, by increasing the responsibility of the public, and thus enforcing parties inviting designs in competition to first mature their own plans. No objection can well be taken to the terms in the Government offices competition, except that the first prizes should have been the *unconditional* professional employment on the usual professional terms. In respect to the regulations, it should have been stipulated that the perspective views should have been all taken from one point. I am also strongly of opinion that the practice of submitting designs under motto should be abandoned. It is no preventive against favouritism, or an unjust decision; in fact, it will be found to foster these abuses. It also tends to lower the character of competitors, induces the submission of many absurd and ill-considered designs, and enables adventurers to compete by hiring the talent of others. The exhibitions of designs before and after the award should also be a condition insisted upon by architects.

Let me now urge upon the Institute the consideration of this most important subject. On what principle are the members honourably bound to one another to pursue private practice upon the usual professional terms, and yet are unfettered and left to their discretion as to their professional conduct

in public competition. Why should an abandoned design prepared privately for a £3,000 building be worth £75, but if prepared for public competition be worth say £20? This is practically the result of non-interference with competition. It is incomprehensible to the public; and, as architects are too willing to compete for the smaller sum, so, when in private practice, they require their just remuneration, it is too often considered an excessive demand. If it be necessary to regulate the private practice for the good of all, how much more necessary to regulate public conduct! I call upon the Council as one of its members to legislate on this subject. Let me beg you to take a lesson from the committee of 1838, and avoid delay. The evils and abuses that existed then were made fully manifest to the Institute, but it was simply content with suggesting remedies. The result of this course is, that in twenty years, such abuses and evils have been neither decreased nor remedied, but have been increased. In the meantime, the number of architects in practice in London has increased from a little more than 200 to nearly 650. Another year will only add to the difficulties of legislation. If this body cannot suggest and carry out a remedy, no other professional institution can; and all the other professional societies are eager for the reform of the present system. Any remedy must emanate from the Institute. In rank, influence, and number of its members, it has no rival. For want of legislation on this subject and a unity of practice, we have seen Sir C. Barry worried and annoyed as to his remuneration while carrying out his great design; we have a hesitation upon the part of Government to carry out their pledges in the Government offices competition; we have all kinds of theories propounded as to our professional remuneration; we have public competition resorted to on the most flimsy pretences; we have public competition avoided by the most talented members of our profession; we have the young artist's career impeded, if not arrested, by disappointed success; and we have public competition unsatisfactory in its results to the public and the profession. To the Council, I have only to urge that it is your bounden duty to take the control of the conduct of its members in public competition, and endeavour to improve the present system. I am satisfied all the members will heartily assist and co-operate in this work: the season is most fitting, and delay will only aggravate the evil. It would be presumption on my part to dictate to the Council or the Institute the course to be pursued. I have endeavoured to touch upon most of the points connected with public competition, in order that they should be calmly discussed, but the principle upon which I would wish to insist is that as public competitions for architectural designs entail a certain loss upon the unsuccessful competitors, it is only a matter of common justice that the successful competitor should have the reward for which he competes, without any reservation whatever, and that architects should resolve to submit designs on no other terms. If architects will resolutely adopt this principle, if the motto system be abandoned, if public exhibition of the designs before and after adjudication be insisted upon, I have great faith that many of the abuses which now beset public competition for architectural designs would be ameliorated. I have essayed to show that it is the abuse and not the use of public competition that has entailed most of the evils which beset the present system; that public competition is advantageous to art, the public, and profession; that any reform must emanate from architects, as they have the control of the terms and regulations; and that the most practical step towards improvement is only the extension by general resolution of the same honourable code of regulations to public competition which exists among all members of the Institute as to their private practice. I feel confident that the public on their part require only to be made fully aware of the duties and responsibilities which they undertake in inviting competition, and it rests with the Institute to enlighten their ignorance, and remove those false impressions which, unhappily, are now so prevalent, and have become so widely disseminated, that even the Government, the guardians and patrons of art, blindly hesitate between justice and injustice.

Mr. PAFWORTH, Fellow, said the question raised by Mr. Morgan required the calmest and most careful consideration; but in asking the Council or the Institute to put the whole matter right, he was calling upon some 200 out of 1800 or 2000 members of the profession to do what should be done by all. The 200 constituting the Institute represented a large majority of the talent of the country; but even if they were to arrange among themselves certain conditions without which they would not compete, how could any possible movement be made to bear upon the boards or committees throughout the country, to induce them to accept those conditions? He saw no way of attaining the object without an entire alteration of the law of the land. Supposing their most utopian views of unanimity were realised in the acceptance of a code by the whole profession, it could not be forced upon employers, and there were, moreover, engineers and builders who, not being bound by the accepted code, would still supply designs prepared by the aid of purchased assistance. Committees would still have competitions on their own terms, and exhibit specious and showy drawings as the result of fair competition. The great injustice of the present system had long been felt; but was there any other profession in which a similar complaint was not made,—especially in competitions for prize essays? He submitted to Mr. Morgan whether, instead of calling the attention of the profession to the present state of things, which they all well knew, it would not be better to lay before them some plan of improvement which they might discuss, so as to arrive at some understanding. If a law could be made binding committees to observe certain conditions, he believed some improvement might ensue.

Mr. KERR, Fellow, said the meeting was very much indebted to Mr. Morgan for the practical business-like way in which he had taken up the matter. He (Mr. Kerr) proposed to consider it as a commercial question. The subject did not require any research into antiquity, or much reference to analogical reasoning. Competition in the nineteenth century was really a very childish thing in its results, and might be illustrated by putting a childish case. Suppose A., a little boy at school, had a capital of sixpence, which he proposed to invest in buns. He caused it to be intimated to B., C., D., and all the other boys, that they might send in samples in the form of one bun each, and having received them, he proceeded to adjudicate by eating them all up; and having come to the conclusion as to which was the best, he invested his sixpence with the successful competitor. Each competitor, not knowing much of mathematics, reasoned thus,—“If I get the order I shall make a profit on the whole, though I shall lose what I have sent in; but that is only the loss of the material.” The result, however, was only obtained at an expence to all the others. Here was a want of commercial principle in the beginning of the transaction; and instead of 2 and 2 making 4, it would, in fact, make something very different. To put another case,—A party, client, wishing to erect a building, employed an architect, and paid him the market value for a design,—say at the rate of one per cent. upon the outlay. He was, however, afterwards advised to resort to competition, because he was not sure that an individual would give him the best design he could have, whereas, with three or four designs he would have so many chances of getting the best. This was, so far, a correct commercial principle; but that which would be payment for a single design would not be payment for a choice of designs. When he was learning the “business,” out of the reach of modern improvements, a banking-house was to be built in the town. There were only two architects in the place, but Mr. Rhind, of Edinburgh, was selected as a third; and this primitive banking company paid each gentleman 100 guineas for his design, and carried out that which they thought best. This, he considered, was overdoing it. As a principle the value of a design was partly to be estimated by the value of the labour involved in it, and partly by its applicability to the required purpose; and if one per cent. represented the market value of a design, it might be assumed that one half of that would

represent the labour and the other half the merit. If five designs were employed, the best design would be represented by a whole value, or one per cent, and the other four by a half per cent. each; the value of the choice of the five designs being three full per centages; and where there were ten or twenty designs the proportion of value to the number of competitors would decrease, though the absolute amount involved in the payment would increase. Another principle to be remembered, was that beginners and junior members of the profession would always be willing to enter into competition on less remunerative terms, and indeed for the mere chance of success. This was a perfectly sound commercial principle, and was indeed the foundation of public competition, but then it became difficult to calculate the value of the choice. The client could not be bound to incur an unlimited expence, even upon the system of calculation which he (Mr. Kerr) had laid down. It was true that where there were a great many competitors of low rank those of a higher would not compete, and this would make up part of the difference of value. If the order of merit were given, and if allowance were made for the inferior standing of the competition, a commercial balance would be established, and it would be found that the value of choice would not be much more than where only five or six designs were submitted. Supposing then, that a competition was opened upon a correct basis, the next great question would be its adjudication; and, as an Englishman, the employer would insist on having the selection himself, and maintain that his doing so was a commercial principle. On the contrary, here was the beginning of unsoundness. If Client was competent to select the best design, he was equally able to do without designs at all. If not, his only correct course would be to go to different designers, and pay each of them. In a competition the adjudication must be according to the standard upon which the designs were made. The judge must be an architect, for an architect only could properly judge of an architectural design. Not all the committees in the world could persuade him that they possessed anything like the knowledge which enabled an architect to decide in any architectural competition; and the calling in an architect was alike for the benefit of the competitors and the client. He was disposed to lay very great stress upon the order of merit in a public competition, and he thought it a pity that the order of merit of the designs for the Government offices had not been published. The profession entered into that competition not for any money consideration, but for acquiring a certain amount of distinction; which had been denied them by the omission to publish the order of merit. This might be done even now, from the notes of Messrs. Angell, Pownall, and Burn. In the case of the Liverpool Museum, sketches only instead of finished designs were called for. Sixteen sketches were sent in, but the experiment failed, from the fact that a large proportion of the selected architects belonged to Liverpool. The Liverpool people had indeed a strong affection for their own townsmen, and that amiable feeling,—rather too commercial in its nature,—might have slightly influenced their decision. He would now suggest a plan of his own. Instead of advertising for designs, he would advertise for candidates; and supposing there were a hundred candidates or two, let them each state their qualifications, and the ultimate cost of the design, and let a proper architect be called in to decide. In no case where an architect had adjudicated had the award ever been pronounced corrupt.

Mr. MORGAN—The Post-office, the Royal Exchange, Brixton Church.

Mr. KERR said he was speaking of recent times. They had, perhaps, improved since the days of the Post-office and the Exchange. Mr. Godwin, Mr. Barry, and Mr. Hardwick had assisted committees in this way, and they had not the slightest difficulty in at once reducing a public competition to a select competition between some half-a-dozen or a dozen designs. If competitions were reduced in that way, and if the instructions to competitors were drawn up properly, and fully

(for nothing could be a greater mistake than withholding information), the result might possibly be more satisfactory than at present.

MR. FRASER, C. V., read some remarks on competitions, from the preface to the catalogue of the designs for the New Houses of Parliament (1886); and urged the great importance of entrusting the adjudication in all cases to none but properly qualified persons. Every one of the judges, in the case of the Houses of Parliament, more or less acknowledged their inability to do what they had done; they deprecated the difficulties they had to encounter, and their incompetency for the task, and whilst they were instructed to recommend the best *five* designs they only selected *four*.

MR. JENNINGS, Fellow, was opposed to the principle of competition altogether. They never were, and from the nature of them they never could be fair. It too often happened that a competitor sent in a design because he knew one of the judges, and could express his ideas, and talk over with him all the requirements of the case, and the judge in return patronized the plan. The judges as a body were generally incompetent, and were ruled by one or two of their number, who were interested in the success of individual candidates. He had himself often been asked to compete,—“because you know Mr. So-and-so, who is an active man, and you can learn what his ideas are.” This however, he had always resisted on principle. He was aware that many young men had no opportunity of showing what they could do, except in competitions, but if they could add their names to their designs openly, the advantage would be much greater both to themselves and the public. They would do better still by exhibiting their designs without any competition. He thought the least objectionable mode of selecting designs for premiums would be to allow the candidates themselves each to select two designs, as they necessarily knew more of the subject than the judges. It was very desirable that the drawings should be exhibited after the award was made, with the names of the authors upon them; for although it was said that an architect who had failed would not wish his name to be known, he thought most persons were so well satisfied with their own designs that they would not object to their being exhibited.

MR. HUSSEY, V. P., agreed that the competitors were best qualified to adjudicate, and that there could be no collusion among them. He had no hope, however, that this plan would ever be carried out, as it would appear to be a confession by the judges of their own incompetency, and a delegation of their authority to inferior parties. There would be a further advantage, that the competitors would award with strict reference to the actual instructions issued, and not according to the peculiar wants of the employers. They would thus hit any faults in the instructions, and competition would be conducted on a better system, and based upon more accurate instructions.

MR. M. D. WYATT, H. S., said he could not agree with Mr. Morgan, in ascribing the revival of Medieval art to the result of competition. To a certain extent it had, no doubt, increased the facility of drawing, more particularly in relation to metal design. That competition had vastly increased the numbers of the profession, there could be no doubt; but it might be questioned whether this was a benefit or not. In competitions generally, there was no genuine test of character or ability; and following out the principle of justice, it would be right to add to the value of any disputable candidate upon the party inviting the competition. The great error was in looking at competition designs as finished works, whereas they were truthful only as educational tests. The employers in effect said to the candidates, “each of you do this, and let me see who does it best.” But if he were to say, “now all go hence, and when you return, bring me a paper on logic,” would there be any certainty whatever that the result represented the ability of the candidates? To have a competition properly carried out, the thing should be done without assistance, under the eye of the

employer, as at the universities. Great complaints were made with respect to defining the conditions of a competition. To do this properly was in fact to make the design, and on the present plan the architect was put in a false position. Instead of being consulted at the beginning, he was only called in after the part in which he could be most useful, and which indeed he ought to be the only person to determine, had been determined upon. This was entirely wrong. He thought if architects would more generally abstain from competitions, and exercise more self-denial, the respectable and clever architects would soon have their talents appreciated; they would be called in earlier, and would come to be looked upon as advisers and not merely as executors. He agreed with Mr. Papworth in the hopelessness of anything proceeding from the Institute being made to bear upon the whole of the profession; but that did not absolve them from making a protest in the right direction. He did not agree with Mr. Kerr, that competition for excellence was a commercial principle. Competition for price (as for any quantity of wool or cotton) was so, but not competition for excellence. He admired Mr. Kerr's illustration, but so far from spending the sixpence after tasting all the buns, he found that was seldom the case in actual competitions.

Mr. HANSARD, Associate, drew attention to the proviso in the last clause of the instructions for the Government Offices, to the effect that "if the successful candidate should be employed," the premium would be deducted from his commission; and the Government no doubt sheltered themselves under this very unfortunate "if." He thought it desirable that some few words of approval should proceed from the Institute in reference to the course pursued by Sir Benjamin Hall, who spoke up manfully for the profession, but was thwarted in every way by the Government then in power, who were determined not to employ the successful architect. With regard to competitions generally, he had adopted the advice of the Council of the Institute, by first writing to the parties for particulars. Sometimes he had no reply, and when he had, the most important answers were almost always omitted.

THE CHAIRMAN, Mr. Ashton, V.P., referred to the Greek mode, mentioned by Mr. Fraser, of deciding competitions by giving to each candidate two votes,—one of which he would give for himself, and the other to the next deserving person. That mode of decision had been recommended at the time of the competition for the Houses of Parliament, but had it been adopted on that occasion, he (Mr. Ashton) did not think it would have led to the selection of Mr. Barry's design, as after the decision a very numerous attended meeting of the unsuccessful candidates was held at the Thatched House Tavern, in order to vote petitions to both Houses of Parliament against the adoption of them. The preliminary conditions of all competitions ought to be defined with the greatest nicety, and not by any one who was not competent to make a design himself. The present system, therefore, began at the wrong end. For example, both for the Houses of Parliament and the Government Offices, the Government in the first instance fixed upon the site. Without consulting any body of architects the Government decided to place the former on the Thames mud, and the fault of site had never been got over; whilst an enormous expense had been incurred in perpetually building up one structure higher than another, to raise it from the mud on which it was so completely sunk. The Government Offices, in like manner, were to be built upon a site quite incompatible with a good arrangement of the block plan.

Mr. HESKETH, Fellow, thought it would be very desirable that Mr. Morgan's suggestion with reference to the Council of the Institute taking the matter up should be adopted, and that some advantage might result if they were to consider the matter fully and to offer certain suggestions in the form of a simple set of rules merely to those committees and boards who were willing to act honestly, because much of the injury of the system of competition arose from a want of knowledge in the parties inviting them. These rules should prescribe the manner in which the drawings

should be tinted or finished, and should exclude any over exhibition of figures in the perspective views, and at the same time enforce uniformity of scale and other important details.

Mr. KERR had no doubt that the Architectural Association, which had given some consideration to the subject, would adopt anything which the Institute might recommend.

Mr. M. D. WYATT said he had omitted to point out, as one of the most injurious effects of competition, the very early period at which it took a young man from his studies. He had himself been applied to for employment by young men who had gained premiums in local competitions, but whose abilities were very limited: and in one case he found that a salary of a pound a week was the most which the services as a temporary assistant were worth. It was evident that this young man required four or five years' hard work before he should have competed; but if he had been able to employ a better draughtsman than himself he might have shown a better drawing. He thought the effect of the temptation held out by these competitions, in stopping that course of education which could alone lead to eminence, was one of the most serious evils. Every architect knew that it was only after ten or twenty years of serious work that he began to know his business well, and it was extremely dangerous to have his attention diverted from study in early life.

Mr. MORGAN said he should be perfectly satisfied with the result of his paper if it were referred to the Council. He looked upon competition as unavoidable, and he looked upon the present state of architecture as mainly owing to it. Sir Charles Barry's Church at Brighton—his Traveller's Club—Manchester Athenæum—and other great works, were all the result of competition.

Mr. M. D. WYATT observed that the late Mr. Pugin never entered into a competition, yet it was impossible to ascribe the present state of Gothic architecture to any person more than to him.

Mr. MORGAN admitted this, but stated that Pugin had imitators who did compete, and through whom his system became more widely spread.

The vote of thanks to Mr. Morgan having been carried, the meeting adjourned.

ON THE EGYPTIAN OBELISKS IN ROME AND MONOLITHS AS ORNAMENTS OF GREAT CITIES.

By the Rev. RICHARD BURGESS, B.D. Honorary Member.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, May 31st, 1868.

I INTEND the latter part of the title I have given to this Paper to stir up a question rather than settle a point; the question to be agitated is, are monoliths suitable as ornaments of our metropolis? Have they not something more severe, sublime, and erect, than a mass of masonry reared in air, or an equestrian statue mounted on the attic of an ornamental gateway? The inscription "graven with an iron pen and lead on the rock" was the most ancient as it was the most durable of monuments, and our Druidical ancestors have at least shown us that if we want a memorial to be lasting, we should lift up in air a mass of stone, and it will tell its story to a hundred generations. The monument which the builders on the Plains of Shinar intended to erect of brick and slime was a failure. The stone which a Patriarch reared with the help of his servant was said, many centuries after, to have remained "until this day." It is remarkable in our day of mechanical power, that we should shrink from undertaking what the ancient men of Egypt seem to have found so easy. Herodotus tells us of the Monolith Temple of Latona, which from its dimensions must have weighed 5000 tons, being removed from nearly one end of Egypt to the other, a distance of 600 miles. And yet the largest mass moved in modern times (carried only a few miles with prodigious labour) I mean the solid mass of stone which supports the statue of Peter the Great at St. Petersburg, weighed only 1200 tons. The French found no small difficulty in transporting the Obelisk from Luxor, and all the power and might of England shrink from the attempt to get up and bring home Cleopatra's Needle. There are now lying in the quarries of Egypt two half cut obelisks which might be easily obtained; another at Hieropolis that might be had; and if the experiment were tried, I doubt not that we could get obelisks of near 100 feet high out of our own quarries in Cornwall or in Aberdeenshire. But I cannot expect to carry this Institute with me in this suggestion unless I can succeed in commending to it the obelisk as an object interesting in itself, and magnificent as an ornament. I fall back, therefore, upon the first clause of my title, on the Egyptian obelisks in Rome.

After the battle of Actium, which put Octavianus into possession of the Roman world, Egypt was reduced into the form of a province, and its monuments (of great antiquity) lay at the disposal of the Emperors. Augustus immediately began to remove Obelisks to Rome, and his example was followed by his successors down to Constantius. During that period of 340 years, those Imperial Expeditioners had managed to import 48 of those monoliths, which were all set up in Rome, and found standing in the time of Valentinian and Valens, A.D. 364. In the regionary or catalogue of public buildings made at the time by Publius Victor, we read, "Obelisks (great) VI. viz. two in the Circus Maximus, the greater of which is 132 feet, the less 88½ feet; one in the Vatican 82 feet; one in the Campus Martius 72 feet; two at the Mausoleum of Augustus 42½ feet each. Obelisks (small) 42. Upon most of them are Egyptian characters." It is rather a remarkable fact, and shows the enduring monumental power of a Monolith, that all the six great obelisks have survived the ravages of "the Goth, the Christian, Time, War, Flood, and Fire," and are still erect by transposition, continuing to be the most expressive and striking ornaments of the City of the Popes. Of the smaller ones six only remain above ground, these are not all like the six large ones of genuine Pharaonic manufacture, but some of them of modern date, that is, they were made in Egypt for the Roman Emperors, and trans-

ported at an enormous expense from the banks of the Nile to the Tiber. Besides the 12 that now stand erect in Rome, two are known to exist under the earth, especially one under the Church of the Jesuits of a large size, and there is one at Florence; but there are still more than thirty to be accounted for, which may probably yet be dug out of the ruins of ancient Rome. It is not, however, my purpose to make any underground speculations, but to endeavour to illustrate, as well as a little smattering of Egyptian learning may enable me, the twelve obelisks now existing at Rome.

In the original places where those monoliths stood they had a use; where they stand now in a foreign city, they are mere ornaments. They were placed in Egypt generally in pairs at the entrances of large temples, palaces, or royal sepulchres, that they might indicate to posterity by their monumental characters, the meaning of the edifice and the name of the king who had caused it to be erected. They served the same purpose as our epitaphs and inscriptions on less splendid monuments; so that when removed from their original site they of course lose much of their meaning. The ancient Romans, however, did employ them to some purpose, they set them up on the Spina of the Circus, they placed two in front of the Mausoleum of Augustus, and they made use of one in the Campus Martius as the gnomon of a monster sun dial. The name now used for these monoliths is rather ignoble in its origin: *obelos* is Greek for a spit, and *obeliscus* is the diminutive; the form may probably have suggested the word to the Greeks, but the Egyptians had the thing itself in use, for Diodorus Siculus in describing an Egyptian dinner mentions cauldrons and obelisks in which and on which immense joints of meat were cooked. It must, however, be confessed that the obeliscus or little spit is of a most graceful form, it is a monolith, as everybody knows, of four equal sides, gradually tapering from the base and ending in a pyramidion, which is longer or shorter in proportion to the shaft: it was a more poetical idea that likened it to a ray of the sun; "*radium imitetur gracilesceus*," is the elegant expression of Ammianus Marcellinus; its material was the warm red granite taken from the quarries of Syene in Upper Egypt, termed "*Syenite*" by mineralogists, which differs from our common granite in this, that it contains as the third constituent part, hornblende instead of mica; this distinction, however, is not general, for sometimes the mica is seen in ancient obelisks. The characters engraven on all the four sides of those monoliths remained a mystery until some thirty years ago, when the Rosetta stone first gave the key to open it: it seems clear that the ancient Romans knew little of the meaning of those characters, all that Pliny could tell us about them was that the hieroglyphic inscriptions are Egyptian letters, and that the large obelisks brought to Rome by Augustus had engraven upon them, the meaning of nature according to the Egyptian philosophy. Ammianus Marcellinus, who had studied the books of Hermapion, could tell us that the hieroglyphics contained the principles of ancient wisdom, and he says that single characters expressed nouns and verbs and sometimes entire sentences. In modern times we have the voluminous works of the Padre Kircher, in which the most fanciful interpretations are enveloped in thick coats of learning. Warburton's lucubrations are mere theories made to square with his views of certain passages of Scripture; but the learned Swede Zoega, profound in Coptical learning, saw as far into these masses of granite as any scientific eye could penetrate before the last discoveries. We have now learnt that there are three sorts of hieroglyphics:—First, the Hierophantic or sacerdotal characters, the science of painting ideas, or the sounds of a language; here the Egyptian priests carried on a system of mystification by adopting conventional symbols understood only among themselves, it was not writing, but signs, where the figure of a bird or an animal or some object stood for a word or a sentence, as Marcellinus intimates; of this sort of hieroglyphics little is yet known. The second sort of hieroglyphics is called the Demotic, or language of the people (sometimes also called Enchorial, or the dialect of the country or province), here the Egyptian characters are rendered into the popular language or Coptic (the ancient language of the Egyptians); the Rosetta stone helped to make this discovery. The third sort of hieroglyphics is the

Phonetic; that is, certain figures enclosed in ovals stand for letters, which, when put together, form a word where vowels are mainly to be supplied, as for instance KASRS for KAISAROS, &c. a mode of reading which puts one's faith to some trials, but which, however, is too clearly made out to dispute the principle.

I shall now proceed to bring before you the twelve obelisks existing at Rome. And here again, as in other great matters, we have three courses. First, those remarkable monuments may be considered in the order of their antiquity, beginning from their origin in Egypt to the date of their transport to Rome, and from that to the present day. Secondly, they may be taken in the order of erection on the places where they now stand, which would limit us between the year 1586 and 1817. And thirdly, we may view them in the order of their magnitude. The last mode of considering them will be the most convenient, for the references to their respective ages and dates of erection may be easily supplied: as to the antiquity of the genuine ones it will be found that they are mostly of the same period, *i. e.* within the 70 years of the reign of the great Rhamesee. The first in point of size and importance is the Lateran Obelisk. This splendid monolith was originally erected at Thebes in Upper Egypt, in the Propyleum of the Temple of Ammon-ra. Pliny says it was erected during the reign of the Rhamesee, who was King of Egypt during the Trojan war. But obelisk readers discover upon it also the name of Thoutmoësis or Thutmes III or IV, the fifth king of the 18th Dynasty, who is the same as the Morris of the Greeks so renowned for the formation of the lake which bore his name. Ungarelli, the Barnabite Monk, assigns it an antiquity of 1740 years before the Christian era. If we are to believe Pliny, the king who first set it up was nervously interested in its safe erection, and fearing the machinery employed would be insufficient, without the greatest care, he tied his son to the top of the pyramidion, to ensure, not the safety of the heir to the throne, but the safety of the mass of granite. We should, I think, one and all protest against our heir apparent being staked against such odds, even if it were to secure the safe hanging up of Big Ben at Westminster. The name of Rhamesee is also read on this obelisk as having restored the temple which his predecessor Thoutmoësis had erected. After remaining for more than 2000 years in its native city it was floated down the Nile to Alexandria by Constantine; that Emperor intended it to embellish his new city on the Bosphorus, but having died before he accomplished his design, his son Constantius preferred to bring it to Rome. In a vessel provided with 800 oars, he caused it to be brought to Ostia, and thence up the Tyber to the Vicus Alexandri, a small landing-place about three miles below Rome; from that place it was dragged slowly on Chaulmici, or low-wheeled waggons, through the Piscina Publica, and with considerable labour set up on the Spina of the Circus Maximus, A.D. 357. When it fell from its base it would be in vain to speculate; it was found in 1588 interred at the depth of 24 Roman palms, and broken into three pieces. The vigorous Pope Sixtus V. caused it to be erected under the directions of the celebrated architect Fontana in the place where it now stands, near the Lateran Basilica. It stands upon a large pedestal of red granite, and measures, without the basement, 148 palms; it lost some of its original length in the pieces being put together, but if we measure from the ground to the Cross which crowns it, it stands 204 palmi or 145 feet high; its weight is estimated at 437 tons. It is covered on all the four sides with hieroglyphical characters, which read in three slips or columns from top to bottom; at the base of the pyramidion or Capitulum Trabis, we have a group of two figures with inscriptions above them four times repeated. Ammon, the King of Gods, is seated with his insignia of Deity, and Thutmes or Thoutmoësis IV kneels before him; the god holds out to the king the symbol of life while the king presents to Ammon in return two cups of wine; on the left above the god is written "The bestower of perfect life, fortitude and all goodness, Ammon-ra, Lord of thrones, and of both Egypt, Lord of Heaven who carries at the seat of Thebes." And again, spoken of Thutmes, "Lord of the upper and Lord of the lower regions, pleasant in his kingdom as the Sun in Heaven." We might go on to read, "Horus replenisher, Distributor of dominions, Guardian of the double watch;" these

are sufficient specimens of the style which runs through the whole: as we descend we come upon the name of Rhameses VI. supposed to be the great Sesostris, "greatly beloved of the Sun, he is the friend of truth, he is life-giving as the light," in short these hieroglyphical panegyrics are the very hyperboles of Oriental metaphor. The Sultan is still called in public style and title "Governor of the Earth, Lord of three Continents and two Seas," and very often Ilunkier, "the Slayer of Men." Byron entered fully into the sublime phraseology of the Harem, when he introduced old Baha delivering his message to the Sultana—

"Bride of the Sun, and Sister of the Moon
(Twas thus he spake), and Empress of the Earth,
Whose frown would put the spheres all out of tune,
Whose smile makes all the planets dance with mirth,
Your slave brings tidings—he hopes not too soon—
Which your sublime attention may be worth.
The Sun himself has sent me like a ray,
To hint that he is coming up this way."

I know of nothing which gives a better idea of the style and language employed on Egyptian obelisks than this stanza, and it will save me much trouble in reading, and you in hearing the vain repetitions which fill the sides of these monoliths of Egypt.

Leaving now the Lateran Obelisk we come to the next, in point of magnitude, viz. that which now stands in the centre of the Piazza S. Pietro. The main interest attached to this is the account of its erection by Fontana; this peculiar interest arose from its being the first experiment of setting up a fallen obelisk in modern Rome, and from its being in one unbroken mass, weighing 331 tons. It was brought to Rome from Heliopolis by order of Caius Caligula, to ornament the Circus which was subsequently better known by the name of Nero, by whom it was enlarged and embellished; the site of that Circus was where the sacristy of St. Peters now is, and therefore the obelisk stands not more than 300 yards from its original position; it took four months to move it that distance. Sixty cranes, 140 horses, and 600 men were employed in the operation. Our celebrated engineers no doubt performed a greater feat when they took only two months to move the Leviathan ship, but they had all the appliances of modern science, and had the advantage of an inclined plane. Full details of the machinery employed in erecting the obelisk of the Vatican are given in a work by Fontana himself, which you have in the Library of this Institute; the expense of erection amounted to 40,000 scudi, or £9000., and the architect's commission was the value of all the timber, iron, and ropes used in the execution, which were worth £4500.; if anything more should be said by parliamentary economists upon the commission charged by our modern Fontana, I should recommend him to appeal to the tariff of Pope Sixtus V, who gave not five per cent. but fifty. The Pope had issued an order that no one was to speak above a whisper during the anxious moments of placing the obelisk on its pedestal, upon pain of death, and you have all heard the story of the English sailor who happened to be present and seeing the ropes stretch beyond the calculation, broke the silence by shouting out "Wet the ropes!" But the English sailor has a competitor for fame, the bold advice is attributed to a member of the Bresca family of San Remo: there is an old picture in the Vatican Library which represents the man seized by the guards; he was taken as a culprit before the Pope expecting to be condemned, but instead of executing the threatened punishment, Sixtus told him to name his reward, and he chose the privilege of supplying palm branches to the Sistine Chapel, and his descendants still claim the monopoly. This obelisk was set up in 1586. It is said by Pliny to have been cut out of the Syenite rocks by Nuncorous the son of Sesostris, and dedicated by him to the Sun, but there is much obscurity about the passage; we are not aware that any genuine Egyptian obelisk was ever set up without figures, but the Vatican

obelisk is plain: the probability is that it was cut by order of Caligula in the Syenite quarries, and being brought to Rome was dedicated by him, as the inscription still proves, to the memory of Augustus and Tiberius. If we include the base and ornaments at the top the whole height is 127½ feet: it serves as the gnomon of a monster dial, which was traced on the pavement of the piazza by Pietro Maccarani in 1817, and there it stands between the two beautiful fountains, having completed its 1800 years since it was first set up in the Circus where the first Christians were thrown to the lions.

The Flaminian Obelisk, which salutes the traveller from the North as he enters the Piazza del Popolo, is the third in magnitude, but the first that was introduced into Rome; it is one of the two which Augustus conveyed from Heliopolis, and it was set up on the Spina of the Circus Maximus. The inscription on the pedestal, which is ancient, tells us that Egypt being reduced into the power of the Roman people, the emperor dedicated this trophy to the Sun. This obelisk was discovered among the ruins of the Circus, lying at a depth of 24 feet below the surface; it was broken, like that of the Lateran, into three pieces; it was taken up and removed by order of Sixtus V., in 1589. The height of the whole, from the ground to the summit of the cross, is 115 feet 6 inches. Fontana also designed a beautiful fountain at the same time he set up the obelisk; this was demolished in the Pontificate of Leo XII., and the four lions of Egyptian style, vomiting water into the four round basins, are the invention of Giuseppe Valadier; perhaps he intended the quattro leoni to have some hierophantic allusion to the living Pontiff Leo XII. There is no doubt of this obelisk being a genuine Pharaonic monument; its four sides are covered with hieroglyphics, they run down as they read in three slips, the outside is by Rhameses, the middle by his father Sethos II. It affords matter for an antiquarian dispute, if we were disposed to indulge in the pleasure of doubting. The question would be whether this or the Lateran obelisk is the one which Ammianus Marcellinus found interpreted in the books of Hermapion; Champollion confesses that the reading of Hermapion comes near to his own translation. The obelisk was made by one of the two brothers Mandouei and Susirei, probably the same as Sethos II., and it was originally placed before the Temple of Re Athom at Heliopolis; like all the other genuine obelisks at Rome, it also bears the name of the great Rhameses, who came after Sethos II. It is believed by Egyptologists that this Sethos was the Pharaoh who was drowned in the Red Sea, and being held in abhorrence by the Egyptians, his name was effaced from all public monuments; it has been pointed out that the title in some of the ovals on the Popolo obelisk has really been defaced. If this should be ascertained, it would add greatly to the interest of this monument; but there is enough made out to assign to it an antiquity equal to the age of Moses. It was probably cut during the latter part of the residence of the Israelites in Egypt by the new king, that is, the king of a new dynasty, who knew not Joseph. On the southern side of the obelisk, M. Champollion reads thus—Horus Seigneur de la region superieure et inferieure, fort et element, ami de la verité, seigneur des panegyrics comme son Père, le Dieu Ptaha, roi du peuple obéissant, soleil gardien de la verité, approuvé par Phrè, fils du Soleil, chéri d'Ammon, Rhameses pieux envers les Dieux, a réparé leur temples, lui, le seigneur du monde, vivificateur comme la lumière.—Horus, god of the Sun, is a title of the Egyptian dynasty, and Phrè is an ancient god of the Sun. Sixtus V. did not allow the inscription of Augustus to monopolize the pedestal; he made the Madonna share in the honors of the Sun by a pious turning of a phrase to which no one can object. One of his inscriptions in Latin, when translated, reads thus:—the obelisk speaks, "I rise more august and more joyful in front of the sacred shrine of S. Mary, from whose virgin womb, in the reign of Augustus, the Sun of Righteousness arose." Whatever may be thought of the mixture of sacred and profane on the same base; standing by this monolith in the Piazza del Popolo, it is difficult to contemplate without emotion a genuine object of antiquity which leads us back to the time of Moses.

The other obelisk which Augustus erected in the Campus Martius, known by the title of

Campensis, is the fourth in order of size, and it stands now on the Monte Citorio. It was originally made use of for a meridian, of which Pliny gives us some description. None of the obelisks at Rome have their characters so beautifully executed as this one; it was the admiration of Winkelmann. Pliny tells us it was made by Sesostrius, but he seems to have made a mistake between the two which Augustus set up; for on the Solar obelisk is read the name of Psammeticus I, the 26th of the Pharaonic dynasty, date from 654 to 569 before the Christian era. Psammeticus was the father of Pharaoh Necho, who killed Josiah King of Judah, and took his son Josiah a prisoner into Egypt. He styles himself "The wakeful Lord and King of Upper and Lower Egypt," and he erected the obelisk at Hierapolis, from whence Augustus brought it to Rome. After thirty years, for some cause which Pliny cannot explain, the sun-dial of which it was the gnomon went wrong. Some of the lines of the dial were brought to light in laying the foundation of the Sacristy of San Lorenzo in Lucina, in 1463. The obelisk itself near the site of the church was seen, for the first time, in the Pontificate of Julius II. Pope Sixtus V. did not think it worth his while to gather it up. Benedict XIV. caused it to be extracted from the ground by Niccolò Zabaglia, foreman of the handicraftsmen of St. Peter's, and in 1748 he deposited it in the Court of the Palazzo Vignaccia, and put an inscription, which is still there. Finally, Pius VI. (Braschi), in 1792, caused it to be erected in the Piazza Monte Citorio, where it now stands. Its total height is 103 feet 6 inches; it required considerable repairs, and these were done with granite, taken from a column of Antoninus, which was found, much broken, not far off; on the summit, a globe of bronze with a spear's head was placed, and a hole pierced through the globe to let the sun's rays pass through at mid-day. It is of all the obelisks at Rome the one that had suffered most. It does not appear, from Pliny's account of this obelisk, that the Romans knew much about the science of dialling, and some of them had rather that such inventions for keeping time had never been brought into practice. Timepieces are very disagreeable to the lovers of the dolce far niente. My friend, Mr. Thomson, of Banbury, to whose paper on obelisks, read two years ago in Edinburgh, I am vastly indebted, has taken from Thornton's translation of Plautus a fragment preserved by Aulus Gellius, in which an idle fellow anathematizes the invention of dials.

The gods confound the man who first found out
How to distinguish hours! confound him too
Who in this place set up a sun-dial,
To cut and hack my days so wretchedly
Into small portions. When I was a boy
My belly was my sun-dial, one more sure,
Truer, and more exact than any of them.
This dial told me when 'twas proper time
To go to dinner, when I had ought to eat;
But now a days, why, even when I have,
I can't fall to unless the sun give leave.

The fifth obelisk in height now stands in the Piazza Navona. It is known by the name of the Pamphilian, so called from the family name, Pamfili, of Pope Innocent X, who, in 1651, employed Bernini to gather up the pieces, and set it up, where it now is, in front of the Church of S. Agnese, towering above a fountain; which, if not the most tasteful, is one of the most curious devices we meet with at Rome. This obelisk was first used for adorning the Circus Agonalis, the site of which is now occupied by the Piazza Navona, and it is now known to have been cut by Domitian. The penetrating eye of Winkelmann detected the imitation long before the hieroglyphic writing was discovered. Dr. Young also detected the comparatively modern cutting of the characters. We are

The quotation from M. Champollion, page 171, at the end of the paragraph, should read thus :—
*Hôrus, Seigneur de la région supérieure et inférieure, fort et élément, ami de la vérité, seigneur des Panégyries * comme son père, le Dieu Phtha, roi du peuple obéissant, Soleil gardien de la vérité, approuvé par Phré, fils du Soleil, chéri d'Ammon, Khamsis, pieux envers les Dieux, a réparé leur temples, lui, le seigneur du monde, vivificateur comme la lumière.*

* Assemblées civiles ou religieuses.

“ ~~benignant principle~~ ”

“ world, who, by means of an image and appropriate ceremonies, is drawn to the exercising of his power.” After this flight of the imagination and learning run mad, we may safely consign the six folio volumes of Father Kircher to the old book-stalls in Holborn. From the Circus Agonalis this obelisk was transferred, about A.D. 307, by Romulus, the son of Maxentius, to the Circus on the Via Appia, which used to be known as the Circus of Caracalla; there it was found broken in many pieces, and five of the largest fragments were removed and set up where they now stand. Bernini declared he had gathered up every morsel, but in the excavations made by the Duke di Bracciano in 1825, several pieces were found, and the foundations of the pedestal on which it stood, as well as those of the other ornaments. Like all the other great obelisks, this was dedicated by the Romans to the Sun, and it is evident that this idea was borrowed from the Egyptians; it confirms the poetical notion of the origin of the form of the obelisk, that it was a petrified ray of the great luminary. The adoration of the source of light and heat, the most resplendent visible image of an invisible Being, whom the Orientals knew not, was, perhaps, the most sublime worship that the natural man could adopt; and in the fanciful mythology of the Greeks and Romans, perhaps Apollo, the god of light and poetry, is the most respectable personage in Olympus. On the Spina of the Circus his statue stood next to the obelisk, and struck the key note of the allegorical allusions in the chariot race. The Metæ at each end of the Spina (the Obelisk in the middle) represented the East and West, or the Sun's day course; the twelve doors from whence the chariots issued, were the twelve signs of the Zodiac; the four factions, with their respective colours, were emblematical of the four Seasons; the two yoked chariots were the Moon; the four yoked, the Sun; the seven times round the spina, which was the usual length of the race, sometimes symbolized the seven days of the week, and sometimes the seven Planets, the “*Equi desultorii*,” who preceded the chariots, were the morning stars that heralded the day; and thus the poet and the astrologer indulged their imaginations amidst the clamour of the multitude. On the top of the obelisk was a brass globe, called the *Pyropus*, with an arrow's point looking to the sky; the sun's rays alighting upon the polished brass, made a strong reflector, which seemed to bring the god of day nearer to the race-course. “*Flammaque imitante Pyropo*,” is the description of Ovid. The Sun, as Apollo's statue on the spina indicated, presided over the races at Rome. This is more than can be said generally for the races of Epsom, and there does not appear to be any apprehension of Sun worship at our great games. The only similarity between the Derby and the Ludi Circenses, which seems to have survived the effacing power of Time, is, that when the Editor *Spectaculorum* had announced the time for the great race, the Senate did no business on that day. The top of the obelisk was sometimes adorned with the palm-branches which the victors had won, and sometimes with roses. Nero collected all the crowns he had won, and fastened them on the top of his obelisk in the Vatican Circus; as to roses, the very idea causes Argoli, the learned antiquary, to dance with delight. “*Quam-bene*,” he says, “*nam obeliscus in spina circi et in obelisco rosa*.” I need not observe where the bon mot lies: spina is a thorn as well as the back-bone of the circus. But enough is now said of the Pamphili Obelisk, which stands above Bernini's Fountain. The shaft is 52½ feet long, the whole height 95½; giving 30 feet for the ornaments of the basement. I must now hasten through the other seven obelisks, and it will suffice to say of the VIth and VIIth,

that they were a pair cut out by the Emperor Claudius, and brought to Rome a.n. 57, for the purpose of being placed on each side of the entrance of the Mausoleum of Augustus. One of them was removed by Sixtus V, in 1587, and placed where it now stands, in the Piazza di S. Maria Maggiore. It was found broken into five pieces, and the jointures are visible. The fellow to this obelisk was not re-erected until 1786, when Pius VI. ordered it to be set up on the Quirinal Hill, between the two famous groups of men and horses. The Esquiline and Quirinal Obelisks have no hieroglyphics and no pyramidion. The length of each shaft is about 47 feet, but that is nearly doubled by the tops and bottoms which are added for ornament and elevation.

The VIIIth now stands on the Trinità dei Monti, where Pius VI. placed it in 1789. It was originally made by Hadrian, whose name, together with that of his wife Sabrina, and his favorite Antinous, was read in the orals by Champollion; the hieroglyphics are rudely cut. Not improbably it was first erected in Egypt in honor of Antinous, who died in that country, and was canonized as an Egyptian divinity. When and by whom it was brought to Rome, no one knows. It is 44 feet in length, but with base and ornaments 96½ feet. It is known by the name of the Sallustian obelisk.

The IXth is the Aurelian, so called because it was found among the ruins outside the walls of Sta. Croce in Gerusalemme, where the Circus of Aurelian is supposed to have been. It was removed from one place to another, until it was finally erected on the Pincian Hill, in 1822, by Pope Pius VII. It is 53 feet 9 inches high, with its ornaments, but has only 29 feet 9 inches of the genuine Egyptian granite. This, as well as the three smaller ones yet to be mentioned, are covered with hieroglyphics. A temple of Isis and Serapis stood in the Campus Martius, near to where now is the Convent of the Minerva; and this temple has furnished from its ruins, no doubt, the three real Egyptian obelisks which remain to be described. They are respectively 19½ feet, 16 feet, and 8½ feet high. The first, Macuteo, so called from the Piazza San Macuto, where it formerly stood, was removed by Clement XI, in 1711, to where it now is, in front of the Pantheon. The second, the Minervan, was erected by Alexander VII. (Farnese), in 1667. Bernini mounted it on the back of an elephant made by Ercole Ferrata, and the idea is illustrated by one of the Papal inscriptions. The reader is to understand that as the strongest of beasts carries the obelisk, which contains the weight of the learning of the Egyptian sage, so does it belong to a robust mind to sustain the weight of solid sageness. The play is on the word *sapientia*.^{*} The name of the great Rameses is said to be read on the other two small obelisks; the last of which is that which now stands in the Mattei Villa, belonging to Prince Godoy, better known by the title given to him by the first Napoleon, The Prince of the Peace. The Roman Senate made a present of this obelisk to the Duke Mattei, in 1582. We know nothing of its early history.

Now these twelve obelisks, as they stand in their places at Rome, are not simple shafts as they were made by the Egyptians, but they are all placed upon pedestals (some of them out of all proportion), and they are all surmounted by masses of bronze or metal, the insignia of Popes and other devices. I think we shall all agree that the pyramidion, so suitable to the form of the obelisk, and so indicative of its meaning, ought to have been let alone; and if "Apostolic statues climb, to crush the Imperial urn, whose ashes sleep sublime buried in air," to which I see no objection, that is no reason why Papal emblems should be stuck "on the point of a needle," or be made "to ride on a beam of the sun." If ever then it should happen that we should begin to adorn this metropolis with monoliths from Egypt,

^{*} It is however much more interesting to know that on the Minerva Obelisk is read the name of Psammeticus, the fourth from Psammeticus I, in the Saitic dynasty, 619 A.C.; his memory is preserved in the book of the Prophet Jeremiah, c. xxxvii. The prophet in his reign was taken away into Egypt. He is entitled on the obelisk the begotten of the Sun; the Sun making glad the heart.

or from Aberdeen, I should hope the pyramidion may be left to assert its own dignity in the face of clouds and sunshine. But the question of the basements may fairly be made a subject of discussion, and one object I have in view this evening is to throw that question in medio for more learned and tasteful heads to take up, and I am happy to find that I am to be followed by a gentleman who is as anxious as myself to see monolithic obelisks of a convenient altitude introduced into our metropolis.

I shall not attempt to invade the special province which Mr. Bell is to occupy this evening, but, if I may, I will give him this word of sympathy before he begins, that I am a believer in Entasis, and I should not regret to see my shafts (providing the points are not touched) shooting up from his ornamented basements; but I am particularly anxious to enlist your sympathies for the monolith obelisk as an ornament and durable memorial suited to such a metropolis and such a nation as this. I have no respect for this placing one stone upon another when we have a public monument to erect in honor of a great man; they will all be loosened and want repairing long before Macaulay's New Zealander contemplates the ruins of St. Paul's while standing on London Bridge, but a monolith, if set up in front of the Exchange, might survive to indicate at the end of 3000 years where the three per cents were once done at 98, and where the Egyptian Hall stood by the side of the Egyptian obelisk. Besides, the discoveries which have been made in the most ancient writing of the world are rendering hieroglyphics every day more interesting, and none have more cause to rejoice than we who are the interpreters of our sacred Books in the results of this modern field of literature. Every colossal figure disinterred where Nineveh once stood, and every papyrus that is unrolled confirms the accuracy of our sacred history, every obelisk deciphered contributes something towards completing the succession of the kings of Egypt. We shall soon know the line of Pharaohs from the time of Abraham to the reign of the Ptolemies, and the impugnors of the chronology of the Old Testament history will have to go into obscurity before the petrified sun's rays of Egypt. There is something of a Providence in this which we cannot but admire, that in an age remarkable for its craving for material proof of every proposition, which believes little except that which it can see and taste and handle, an age in which scientific discovery had begun to wave the flag of triumph over revolution, there should have been left concealed in the earth, or hid from the knowledge of man, a series of evidences which have proved the accuracy of those Scriptures which were given to make men wise unto salvation. I look forward to a great advancement in this walk of literature. I see no reason why in the course of another generation our national schoolmaster should not by way of a treat to a dozen of his best boys take them out on a half holiday to read the obelisks that may be set up in Trafalgar Square (when it is a square), or Palace Yard, when it becomes an open court, or on the table land of Hyde Park, or in front of Buckingham Palace, and that the name of Victoria in hieroglyphical signs be as familiar to the eye as "God save the Queen" is to the ear.* Have you not all read with perfect ease the hieroglyphical name of the Emperor Domitian, and could not every one here present make a phonetic Victoria and Albert for himself? If ever this scheme should be brought about, I ask no more honour for the suggestion than that our own hieroglyphical symbol with which our honorary secretaries sometimes puzzle the uninitiated, R. I. B. A., may have an oval on the obelisk which is to be first reared at the West End; for R. I. B. A. has as much right to be "a beloved of the Sun," as any "Horus" of ancient time, for R. I. B. A.'s works are all made for the sun to shine upon, and architecture even in its ruins is "beloved of the Moon."

* In the laborious, skilful, and elegant work of Messrs. Arundale and Bonomi, the hieroglyphic name of Victoria, as ruler of the world, is at the head of the title-page.

Vol. I. Transactions of the Royal Society of Literature, 1843, contains a table by Mr. Bonomi, exhibiting all the Egyptian Obelisks then erect.

ON THE APPLICATION OF THE ENTASIS TO THE OBELISK.

By JOHN BELL, Esq.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, May 31st, 1858.

BEING a sculptor and not an architect, it is with some hesitation that I make any remarks in addition to what has been said on the subject of obelisks; but perhaps your kindness will receive the few words I have to say with indulgence, as it regards a subject which may be thought to possess some degree of novelty, viz., the consideration whether the principle of the Entasis may not be advantageously applied to the obelisk.

My attention, about three years ago, was drawn to the subject of obelisks by my having selected an obelisk as the principal feature in a design I made about that time for a memorial of the Great Exhibition of '51, in Hyde Park. It was not, however, until my attention had been for some time turned to this architectural feature that it occurred to me that had the Greeks adopted it as they did various other component parts of architecture, for which I believe it is *en règle* to consider that they were indebted to the Egyptians, that there was at least a possibility that they would have modified it, in some degree, as they had done in regard to other architectural features—columns for instance. I believe I am correct in saying, that in whatever the Greeks adopted from other nations they made modifications, making it thus, as it were, their own: and that in passing through their hands the rough-hewn ideas of their neighbours became not unfrequently refined to a degree of perfection that later times have been able to do little more than repeat. If then they had adopted the obelisk, would they have left it as they received it from the Egyptians? I fancy not.

The tomb of Beni Hassan, in Nubia, presents pillars which have received the name of proto-Doric, on account of the remarkable and close similarity which exists between them and those of the Greek Doric Order; and perhaps the chief point in which they do not resemble each other is that the Egyptian type possesses no Entasis, but that the shaft although it tapers from base to summit does so throughout equally and in straight lines, while the Greek Doric has an entasis. In some, however, of the Egyptian columns the shafts contract also at the base, but still, I believe, there is nothing like a scientific entasis, analogous to the Greek in principle, to be found in any of these cases. I shall be glad to be corrected if I am in error in my supposition that thus the scientific compensatory application of the entasis, so as to satisfy the eye thoroughly, was reserved for the Greeks to arrange on just principles and to carry out with exactitude and beauty; I say "compensatory," inasmuch as I presume that a just entasis, or any curve or modification applied on similar principles, is never intended to strike the eye separately, as a form of itself, but merely to be compensatory of some optical delusion by means of a delicate adjustment, by which fulness, harmony, and unity was restored to the whole effect. Mr. Penrose, in his remarkable work on the "Principles of Athenian Architecture," in his analysis of the entasis of the columns of the Parthenon, considers its curve to be hyperbolic, and computes its divergence from the straight line at about 1 in 550 of the height of the shaft. The entasis of the columns of the small and large order of the Propylæum he also considers to be hyperbolic, and computes their divergence as somewhat more, viz., respectively 1 in 500 and 1 in 400.

I did not attempt, of course, in my little sketch a nicety which my means and material would not afford me, but the idea of applying a somewhat similar divergence to the obelisk arose in my mind, from perceiving I fancied a certain crudeness and harshness, and a want of bulk in the centre portion to

exist in the rectilinear obelisk as a form, and that the long lateral straight lines even possessed in appearance a somewhat concave character, which suggested compensation, as in a column, and thus it occurred to me to apply to my little model of an obelisk something of the same entasis which Mr. Peurse had recorded of the Athenian columns. The little photographs you see here were taken from this little humble effort on my part, and I may as well enlist your indulgence in its behalf by saying, that the original is only a little plaster model of some 2½ feet high, wholly inadequate in material and scale to at all work out so delicate a problem, and that I merely consider it as a sketch of an idea, by no means presuming either that it rests with me to carry it out. These photographs, also, are on so small a scale, that I must draw rather on your consideration and imagination to accompany the principle of the suggestion than think to illustrate it by means so inadequate. I may, however, here perhaps be allowed to suggest, in case the idea in question finds favour sufficient to encourage its being worked out as an architectural problem, that perhaps slate would be an appropriate material for a test model, which, for the better working out of the several delicate curves, should not, I think, be less than 5 or 6 feet high. I only say this to guard against its being thought necessary for the working out of the problem, that this should be done of large size, or in granite.

However, to return to what I was saying, the first thing I did after I had tried my hand roughly on the effect of the entasis so applied to the obelisk, was to find out, if I could, whether it had been done before, and the work I chiefly consulted on this point was Denon's large work on Egypt. I read a good deal of the letter-press and examined the engravings of various of the most celebrated obelisks of Egypt, which are, as you know, there figured on a large scale, without, however, meeting with any instance of entasis applied to them. Nor have any enquiries I have made, or any information which has been kindly afforded me since, indicated the existence of any divergence as regards the contours of the Egyptian obelisks, except in so far as the faces are found occasionally slightly horizontally rounded; for which perhaps a sufficient reason is perceptible in that this treatment equalized in some degree the width of the elevation and angle views, adding slightly to the former and taking away slightly from the latter. I have not met with any evidence of the Egyptians having gone any further than this in the modification of the rectilinear contours of the obelisk; and in this case it may be observed that the slight divergence is only applied to the sectional plan of the obelisk, and not to any of its upward contours. Neither have I been able to discover any modern instance of the entasis having been applied to the obelisk, although I can hardly fancy but what a similar idea must have occurred to others.

All rectilinear surfaces, bounded by angles, may be perceived I think, when narrowly examined, to have a tendency towards looking concave, whether viewed in front or in profile. And, as I have just said, the contours of a rectilinear obelisk partakes, to my eyes, strongly of this character, especially along the sides of the shaft in profile, indicating a yearning for some kind of compensatory addition and refinement analogous to that which the sensitive and subtle taste of the Greeks found requisite to satisfy their sense of proportion in the column. I am aware, however, that the problem of entasis, as applied to the obelisk is less simple than as applied to a column, in that the first is four-sided, and the column is round. A column, from its cylindrical nature presents a similar appearance in each view (flutes making but an unappreciable difference), whereas the obelisk being four sided and four angled, the curve of entasis on the angles, although directly evolved from the meeting of the curves of entasis of the sides, would vary perceptibly from that of the latter. I have not, however, gone into the delicacies of this question, nor have I tried anything like an arithmetical calculation of the other curves consequent on the introduction of the entasis on the sides. I say consequent because, even on

my little inadequate and insufficient model, as soon as I had applied the entasis to its sides I directly felt that the other lines and surfaces required a similar treatment to make them harmonise with the entasis. Not only did I find that the surfaces of the shaft required rounding, but also that the surfaces of the culminating triangle at the apex, which thus (with a slight entasis on its upward contours, which became requisite as soon as the entasis was made on the shaft) came to assume the form of a triangle, not of straight lines but of three arcs all arching slightly upwards, thus in this acute angled triangle partaking of a curvilinear modification in the same spirit as that applied to the obtuse-angled triangle of the pediment of the Parthenon. Thus in my experience, such as it was, did I find that the introduction of the entasis along the sides of the obelisk induced essentially, as a consequence, a further curvilinear treatment, and that its mission did not appear to end until all the surfaces and lines became also endued with the same principle; nor did the eye appear at all satisfied after the introduction of the entasis while a single straight line remained on any part of the obelisk. On contrasting the little obelisk thus treated with a little example of the same size I had by me in its original state, I must confess that the curvilinear obelisk appeared to me to possess a marked superiority. The rectilinear one, by the side of its companion, seemed to me in comparison to look crude and harsh, and to have a kind of cast iron appearance; while on the other hand the one on which I had been trying my curvilinear experiment, seemed to have gained in richness, mellowness, and completeness. I feel, of course, I may be all wrong, but yet at present I must acknowledge that the incomplete trial I have made does impress me with the belief that if the proper curves for this feature were discovered and judiciously applied, that the result might become in other hands an object of marked beauty. However, I have still a little more to say on this subject. I had in my little obelisk posed it on a base partaking of the forms of a cube and a pyramid, and I found that these surfaces also, when associated with the above treatment of the obelisk, in like manner demanded a similar treatment, so that I did not stop with my rasp and sand-paper until I had reduced all their surfaces and lines also to a similar curvilinear character, still, however, working on the same principle of emulating the precedent existing in the ruins of the Parthenon and other Greek temples, in which we are instructed that the base and foundation lines were slightly arched, as well as those of the column and the tympanum.

In regard to the importance of the obelisk in a monumental point of view, perhaps I may be allowed to say a few words. There is no doubt that in the decoration of a city or its entourage, as in landscape generally, it is desirable occasionally to have high objects of an agreeable form, not only as they effect the skyline and in a directly architectural point of view, and as a centre of roads and avenues, but as drawing attention to some public record erected "in memoriam" of some great man, or fact, or historical incident. Now a column has always been held, I believe, to be open to some objection when used for this purpose, inasmuch as it is a portion of a building removed from its legitimate office and original object, and in an isolated position set forth to do that for which it was not in the first instance designed. It cannot be denied, indeed, that a column used in this way is in some degree an adaptation.

Now, these observations do not apply to an obelisk, which was from the first a feature of itself, not of support but of record, which was set forth, not unfrequently in a twin arrangement, by the side and in advance of the entrances of Egyptian edifices: the obelisk from its inscribed surface being a sort of architectural open book. Thus we have very early authority for this feature being used as a record, for the inscription of which the plain obelistic surface affords a special and peculiar facility. Moreover, a column being designed originally to support something, it artistically demands a finial of some sort, and if erected in honour of any individual, this its quality has frequently led to

the placing of his portrait statue on its summit. Now, I would be far from presuming to make any sweeping objection; but, at any rate, such a situation for a portrait statue is open to remark, as involving an undue distance at which to view a likeness.

Now an obelisk yearns for no such architectural addition. It requires no finial, and indeed, in my idea, any supplemental finial stops its upwardness and destroys its effect. It is complete in itself as a feature of distinction without any addition breaking its line; its surfaces afford ample and appropriate spaces for inscription (of which I think we are much too chary in this country), and its plain and simple base forms an excellent background to a figure placed slightly in advance of it. It is in connection with these requirements of the day, and the qualities of the obelisk as a monumental feature, that it appears to me well worthy of consideration, as well as on more abstractedly artistic grounds, and especially so, if by treatment it can be made our own.

The pyramid and the obelisk if not directly the remains of hill worship and mountain associations, appear to have been directly suggested by these objects of nature. A pyramid is a scarped hill, an obelisk is a splinter of rock fashioned on four sides. For the latter object in nature we have not to leave our own country, the Needles at the Isle of Wight and various other spicula of rock formation of still more suggestive contours, to be found in various parts of our Islands, suggest the type which the Egyptian, in my idea, only carried out in art as it were half-way; that is, to the point at which his architecture rested, and during the ages that have elapsed since his time, the problem does not appear to have been carried any further. I am not aware that the Greek ever touched it. Now, the question I would submit is—Does there or does there not exist in the obelisk an interesting architectural problem yet unsolved? You are architects, and you know much better than I do, I am only a humble admirer of your art—but perhaps, I may not be thought to show this humility in thus uttering my impression that the artistic problem of the obelisk remains still unsolved.

Perhaps I may be allowed to add, that having made enquiries as to the possibility of obtaining monolith obelisks of large size in British granite, I find nothing to prevent it, but that on the contrary, our Isles will afford them of as large a size as any of the Egyptian examples, and probably indeed larger. The quarries of Cheesewring and Lamorna in Cornwall seem especially able to supply such. The weight of such monoliths, if large, of course is great; one of 75 feet for instance, would weigh about 250 tons. But the Egyptians quarried, and moved and erected much greater masses, and they had neither gunpowder, steam nor hydraulic rams. The age of Victoria, is in engineering, I should hope, at least equal to that of the Pharaohs. If I am right, the completing the problem of the obelisk left untouched since their time, and the executing and erecting it (in monolith) in polished British granite, of a size superior to any known example hitherto produced, would (if called for on any occasion) appear to be a triumph of architectural and engineering skill not unworthy of the age and country.

I have, however, but made a sketch and ventured a suggestion, and in this most incomplete and initiatory state, I beg to submit to the Institute of British Architects the problem of applying "Entasis and curvilinear treatment of a compensatory character to the obelisk," and to thank you much for the attention you have before, as well as to night, so kindly bestowed on my crude ideas.

Mr. TITE, M.P., said he had no doubt Mr. Bell was perfectly right in his remarks on the application of the entasis to obelisks. When observing the obelisks in Rome, and that at Paris, he had always felt the insufficiency of their form, and the hollowness of their outline; and the judicious application of a curve he had not the slightest doubt would improve their artistic effect. He agreed with the Rev. Mr. Burgess as to the desirability of introducing the obelisk for monumental purposes, and he particularly regretted that an opportunity had recently been lost, for its employment as a

memorial of the Great Exhibition in Hyde Park. He had assisted the Committee in selecting a design for that memorial, and without the slightest idea that Mr. Bell had suggested an obelisk he had ventured to think that the site of the Exhibition was exactly the situation for an obelisk towering above the trees. There was also the highest authority in support of this view, for it was pretty well understood that the Prince Consort desired that the monument should be an obelisk. He (Mr. Tite) was however in a minority on that question, the majority of the committee preferring a group of statues, which, for his own part, he did not think so well adapted to the situation or the climate as an obelisk. Statues in the open air suffered much from the English climate, and required a greater play of light and shade, and a light approaching in constancy and brilliancy that of Italy or Greece. The grouping of the statues would be imperfectly seen at a distance; while an obelisk, from its simplicity of form and character, would be the finest possible monument in point of taste that could be employed in such a situation. One of the most agreeable instances of the modern employment of the obelisk was that in the Torlonia gardens outside the walls of Rome. The form and proportions of that obelisk were of the best possible kind, and it was an interesting fact that the idea suggested by the Rev. Mr. Burgess had occurred to the archaeologists of Rome, for the names of the Baron Torlonia with those of the Baroness and of the architect who set up the obelisk, were inscribed upon it in phonetic characters in cartouches. The most agreeable example in this country was an obelisk of the time of the Ptolemies brought from Philæ, and set up, he believed, by Mr. Bankes in his park in Dorsetshire. It had often occurred to him that no better kind of monument, and no better form than that of the Philæ obelisk could be adopted for park scenery in England. Small models of this obelisk were commonly made and sold in Derbyshire. Mr. Burgess had spoken of the merits of Fontana, and he might add that that great architect had the further merit of exceeding fairness, and an entire absence of jealousy or absurd vanity,—inasmuch as he allowed his carpenter (Zabaglia), to whom he was indebted for the arrangements for raising the great obelisk, the use of his engravings to illustrate a work published by Zabaglia. In fact the plates in Fontana's book were the same as those in the work of Zabaglia. Mr. Tite proceeded to observe that he had paid considerable attention to the subject of Egyptian hieroglyphics, and he was very anxious to impress upon the meeting that great injustice had been done to Dr. Young, to whom Champollion was indebted for the suggestion of the Egyptian phonetic alphabet. Dr. Young was the first to decipher the proper names on the Rosetta stone, and to show, before the idea occurred to Champollion, that the cartouches generally contained the name of the King, the Emperor, or the God. The facts of the case were all given, and traced *ad initia*, in the life of Dr. Young, which had been recently published. He had no desire to detract from the extraordinary skill, ingenuity, and industry of Champollion; but the French were so uncommonly fond of assuming, a little unfairly, the merit of these discoveries, that he thought every one who knew the facts was bound to do justice to Dr. Young whenever an opportunity occurred of doing so. With regard to the two Luxor Obelisks, it was a curious fact that the upper part of the shaft had evidently been cut, or sunk back, so as to allow a pyramidion of metal to be fitted on to it, without interfering with the regular line of the obelisk. It might be presumed that the metal pyramidion was without any decoration at the top, and probably its surface was polished, in order (as Mr. Burgess had suggested) that the sun's rays might be reflected from it more directly. Modern hieroglyphics had been very successfully employed at Berlin. One of the courts of the Great Museum there was a restoration of the temple of Denderah. It contained the Egyptian Antiquities collected under the care of Dr. Lepsius, and a long inscription on the frieze gave in hieroglyphics the facts of the construction of the museum, the name of the King of Prussia, under whom it was erected, the date of the work, and other circumstances connected with it; the whole of the hieroglyphics being very well arranged and very

intelligible. He was sure the feeling of the meeting must be now, as it had often been before, one of extreme obligation to Mr. Burgess, and of gratification that he should be able year after year to contribute papers of such extraordinary interest. He wished they would themselves follow such an excellent example; for if Mr. Burgess, with his numerous occupations, could do so much for art and archaeology as he was constantly doing, they were bound themselves to do a great deal more. Their thanks on this occasion which he had much pleasure in proposing, would, he had no doubt, be very hearty and sincere. The question of moving large masses of stone was one of much interest. All the facilities of modern ingenuity had been applied to move the great monolithic mass of granite for the statue of Peter the Great from the marshes of Finland to St. Petersburg. The library of the Institute contained a French work by Count Carbur, describing the whole process. The stone had to be moved seven miles through the marshes from the spot where it was found, to the sea, where a ship had been built to receive it. The French engineer who conducted the operations had long plates of iron fitted into balks of timber, and these iron plates had triangular grooves from end to end, and the timber balks were kept in their places under this enormous stone by means of a proper frame-work. The rolling power consisted of large balls of gun metal, resembling cannon balls. The balls were so placed as to impinge upon the triangular grooves, and it was found that there was no friction whatever. As the stone moved on, the timber balks were tilted and shifted forward, and the whole thing was done with great facility and economy, aided as it was by the ground being in a frozen state. It was much to be regretted that the simple principle adopted in this instance had been forgotten in launching the Leviathan, where the mischief had arisen from the use of iron plates acting upon an incline of the same metal, the friction being so great that the one would not slide over the other, even with the advantage of an inclined plane. Engineers commonly used brass, copper, or some other metal in contact with iron to prevent friction; but by the forgetfulness of this principle by the engineers in launching the Leviathan, an enormous expense and delay had been incurred. He was afraid there would be great difficulty in getting large stones for obelisks from Scotland or Cornwall. The quarry-masters made great difficulties about it. He on one occasion required a large block of red granite from the Peterhead quarries, but was told he could not have it because the bridges over the streams which might have been crossed would not bear the weight of it. The truth, however, seemed to be that the present generation built less for posterity, and in a more make shift way than the Egyptians and the Romans; and in fact shrunk from those efforts which the appliances of modern ingenuity would render easily practicable. Cleopatra's needle was allowed to lie perishing, half buried in the sand,—pieces being broken off every day by the donkey boys to gratify the English traveller; and this because neither the government nor anybody else, in spite of many efforts to induce them, were willing to incur the expense of removing it. The useful was now cultivated more than the ornamental, and when an opportunity for the latter occurred, it too often happened, as in the case of the memorial of the exhibition of 1851, that a mistake was made in the character of the monument selected. He thought that a similar mistake had been made in the Edinburgh monument to Sir Walter Scott, which his friend Mr. Playfair had suggested should be an obelisk, not only as a matter of taste, but because Edinburgh, however beautiful in itself, required spires or obelisks to increase its picturesque effect. This suggestion, however, as the meeting knew, had been over-ruled.

Mr. BOWEN, Visitor, said M. Lebas, the Engineer, had found that both the Luxor Obelisks were curved on plan on the east and west faces, but in elevation the east surface was concave, and the west convex. The exact measure of these curves were given in the work of M. Lebas. Mr. Angell had suggested the erection of scaffolding to measure the obelisks in Rome, with a view to ascertain if they really had any entasis, but no attempts had ever been made to settle the question by actual

measurement. Hieroglyphic and phonetic characters had been successfully employed in the inscriptions on the Egyptian Court in the Crystal Palace. These were similar to the Berlin inscription, and written by Mr. Scharf.

Mr. SCOLLES, V.P., stated that Mr. Bonomi had himself applied hieroglyphics to form the name of Her Majesty long before Lepsius or the erection of the Crystal Palace.

THE CHAIRMAN, R. C. Hussey, V.P., said that there appeared to be a prejudice against obelisks, partly from their liability to interfere with the effect of neighbouring church spires, and partly from their resemblance to the lofty chimneys of manufacturing towns. He had been told that when the Luxor Obelisk was raised in Paris, the English Government waited to ascertain the cost of the operation before deciding as to the removal of Cleopatra's needle to this country; but finding that the French obelisk had cost £80,000, they were afraid to ask the Chancellor of the Exchequer for so large a sum.

Mr. C. H. SMITH, H. M., referred to the Nelson obelisk at Glasgow, which he believed was larger than any which had been described, but which was built of an immense number of blocks of stone. With regard to the removal of large masses, the only difficulty was that of finding the money requisite. At one of the earliest meetings of the Institute an account had been read of the removal of the great light-house at Sunderland. This was 120 feet high and 18 feet diameter, and under the superintendence of Mr. Murray it was moved bodily, in an upright position, a distance of 120 yards, and placed upon a new foundation.

The thanks of the meeting having been voted to Mr. Burgess and to Mr. Bell;

Mr. BELL acknowledged the compliment, and said that he believed, from inquiries he had made, that there would be no difficulty in obtaining a block of granite 60 feet long from the Lamorna quarry, Cornwall, for about £5,000., and that it might be conveyed by a timber-ship which had a long hold adapted to the purpose. Its removal on land might be managed by the employment of a number of runners and slips of soaped wood. He had seen this plan used at the French Exhibition of 1855, and he understood it was applied to the moving of masses of great weight with facility and rapidity.

The Rev. Mr. BUCKES thanked the meeting for its approval of his exertions, which were a source of much pleasure to himself. He was really anxious to see some of these fine monolithic monuments occupying the eligible sites afforded in different parts of the metropolis. The great difficulty was to move the Government to spend money in ornamenting the metropolis; but as everything must have a beginning, and as he believed the question only required to be agitated, he should be much gratified if any good result should proceed from the present discussion and from this Institute. He was quite sure if a "Demotic, Phonetic, Obelisk-moving Joint Stock Company" were formed, the practical difficulties would wonderfully soon be removed.

It having been decided that the discussion should be resumed at the next meeting, the members adjourned.

CORRIGENDA.

"In Wayside Memoranda" by T. L. Donaldson, read April 26, 1858, page 145, third line from the bottom, for "crypt of the church," read *crave* of the church; page 146, third paragraph, last line, for *indicate* themselves, read *evident* themselves.

A DISCUSSION ON OBELISKS AND MONOLITHS AS ORNAMENTS OF GREAT CITIES.

Held at the Ordinary General Meeting of the Royal Institute of British Architects, June 14, 1858.

The discussion adjourned at the last meeting was resumed by the Honorary Secretary reading the following communication from Sir GARDNER WILKINSON, Honorary Member.

It has been recommended that obelisks should be adopted in this country for monumental purposes, and the fact of our possessing granite quarries of sufficient size to furnish obelisks even larger, if required, than any erected in Egypt, shows that at least there is no objection to their use from the deficiency of proper materials.

But it may be asked what idea we associate with an obelisk, and what is our plea for adopting it as a monument? We have no feeling, no association, connected with an obelisk. The Egyptians had a reason for its invention and for its employment. And certainly, judging from the position and treatment of obelisks in modern as well as ancient Rome, in France, and in England, it is very evident that there has generally been a misunderstanding of their use and intention. In Italy the point of its *pyramidion*, one of its most beautiful features, has been so overloaded with crosses, rays, and various conceits, as to be deprived of its proper effect, while the lower part of the obelisk has been disfigured by being perched on an incongruous pedestal. Again, it has been generally put up in some open space, as if it were a gnomon; and as its form has been spoiled by an unsuitable addition to its base and apex, so the choice of position has aided in its disfigurement. It is true we do not encumber the summit with monstrous excrescences, yet we generally spoil it by depressing the apex, and substituting for its graceful acute point a heavy obtuse one; showing how little we even care to copy correctly the ready-made model. So far from any Egyptian obelisk having that heavy character, its triangular pyramidion is at least $1\frac{1}{2}$ in height to a base of 1, which gives it that lightness for which it is so justly admired. Thus in the obelisk at Heliopolis the height of the pyramidion to its own base is as $1\frac{1}{2}$ to 1; which is the usual proportion of the perpendicular height to the length of the base of the pyramidion, in obelisks erected or represented by the Egyptians. But besides a frequent disregard for the proportion and beauty of the apex, we show the same misappreciation of the purpose and character of an obelisk as the Italians and the French, by placing it alone in an open space, as if it was admirable only for its height. The Egyptians employed the obelisk as a contrast to the long horizontal lines of the cornice of their temples; and two obelisks were placed for this purpose in front of the towers of their propylææ. They well understood the value of this vertical line, to relieve, and contrast with, the long horizontal line of the building; and by these means what would have had a monotonous, presented a pleasing, effect. The Romans felt a similar want of the vertical line; but they managed it less adroitly; they merely took one member out of a building, and placed it by itself as a new and distinct monument; and the column increased to an unreasonable size was (with their usual poverty of inventive design and deficiency of taste) adopted by them for the purpose. We have not the same want of the vertical line; it abounds with us; and under much better conditions than in a Roman city; we have therefore no object in adopting either the obelisk, or the column, to supply that want.

Besides, to copy the obelisk, with which we have no association of ideas, gives the impression of inability to compose a monumental design. It is a mere repetition of a well known form (even if correctly copied); and if men of talent are to do themselves credit by designing monuments displaying originality and some mental power, they should scarcely be satisfied with the copy of an

object adapted neither to our wants, nor to our ideas. An obelisk before an Egyptian temple is deserving of admiration, because it fulfils the purpose for which it was intended: its form is graceful; and the hieroglyphics also add to its beauty when well cut. These indeed are an important feature in the obelisk; it appears heavy without them; and never looks well, even in its proper place before an Egyptian temple, when unsculptured. But I do not suppose that any copier of an obelisk would advocate the addition of hieroglyphics in this country. If then it is not consistent to preserve this one of its peculiar and pleasing features, how can it be consistent to adopt the obelisk itself, which is injured by their omission? and I see no plea for its adoption as a monument, when neither its object nor its proper position are regarded.

Mr. KERR, Fellow, said that, whilst acknowledging the ability displayed in the papers by Mr. Burgess and Mr. Bell, he was disposed to question first the extreme antiquity assigned by the former gentleman to the great works of Egypt. These Mr. Burgess ascribed to the time of Moses. It was quite natural that the monuments of ancient Egypt should be traditionally connected with the important historical epoch in which Moses lived. He, however, thought this idea would not bear investigation, and that those, who were learned in Egyptian chronology, would acknowledge that the theories on this subject were uncertain, and had not been reduced to such a form as to be capable of ordinary proof. Viewed by themselves, the writings of Moses would be found to present a very complete description of the state of society at the time he wrote; and in his (Mr. Kerr's) opinion, it was impossible the great works of Egypt could have then existed without being noticed by him. In his history, Moses described a very primitive state of society, and a very small population in Egypt; for the Israelites were more mighty than the Egyptians, their masters; and upon the whole he gave such a straightforward account of the state of society in his time, that (even if the Egyptian chronologists were more correct and certain than he believed them to be), he, Mr. Kerr, would be unwilling to admit that such monuments as those under consideration had then been in existence. Passing from this branch of the subject, he observed that Mr. Burgess had appeared to give the weight of his opinion to the idea, that in the power of moving large masses of stone the Egyptians must have possessed some mechanical appliances, which had now been lost sight of. It was, however, unnecessary to dwell upon this point, because upon the very monuments themselves there were complete representations of the way in which they had been excavated and carried down the Nile, and from these it was clear that no mechanical power of any importance was used, but that these great masses were chiefly moved by means of ropes drawn by men. The Egyptian, in handling his obelisk, had only to convey it to the site of erection; but the Romans, who had borrowed from the Egyptian, and not made any for themselves, had to lift it in the air, when transferred to Italy, a performance which demanded twice the effort required on the part of the Egyptian. The Egyptians had no knowledge whatever of the mechanical powers, so called; but they nevertheless succeeded in moving these monoliths by manual labour, and patience, and painful effort, such as at the present day we could form no idea of. So far as he could recollect, Mr. Burgess had thrown out the idea, that the Egyptians regarded the obelisk as symbolizing a petrified ray of the sun. Nothing, however, he conceived, could be more fatal to a proper conception of the Egyptians of that period, who had, in fact, no poetry whatever in their minds; and he considered that the stanza which Mr. Burgess had quoted from Lord Byron would convey a most fallacious idea of their pharmacology. He thought Mr. Burgess had further been guilty of false antiquarianism, in stating that the obelisk was named after a "spit,"—but this he would leave as a question for others more learned than himself. He would proceed to the question of Entasis, which had been treated with so much ability and modesty by Mr. Bell. He thought that gentleman was mistaken in the position he had taken; and that it

was impossible for entasis to exist in an Egyptian design. It appeared to him that entasis was part and parcel of that system, which was peculiarly Greek, and which made the Greeks quibbling, doubtful, and uncertain, whether a straight line did not want some curvature, or whether two and two could make four, without some little help. It was not for the meeting on the present occasion to enter fully into that question, but it did seem to him that the Greeks pushed the scientific details of the philosophy of architecture to an extreme, which could not now be followed out. He thought that the existence of entasis in a column would at once be discerned by the educated eye, and if so there would be an end to the controversy. The reproduction of obelisks in this country seemed to be the primary object of Mr. Burgess's paper, and he had pointed to Rome and Paris as furnishing examples to be followed in London. There, however, the obelisks had been merely carried from Egypt, and set up as trophies of victory and conquest. He was quite sure, that England's "Cleopatra's Needle" would lie under the sands of Egypt till the day of judgment, so far as this country was concerned. The principle, which applied to this question in England was, that money could be appropriated to better purposes than to raising obelisks. Yet if a granite monolith could be erected and polished, it would be a most beautiful monument for the purpose for which Mr. Bell's design had been prepared. That design in itself was admirable, and if a committee of artists had been appointed to determine on the selection, instead of a highly respectable committee of aldermen and other non-professional gentlemen, Mr. Bell might have been more successful.

The Honorary Secretary proceeded to read

SOME REMARKS ON THE APPEARANCE OF STRAIGHT LINES IN WORKS OF ART, by Mr. C. H. SMITH,
HON. MEMBER.

A desire to improve our Architectural taste, or to discover the best mode of doing anything, is not only natural, but laudable; it is only when this desire is indulged to excess, that it becomes dangerous. In every age and community, some particular theory of taste, or peculiar idea of perfection in the Fine Arts, operates for a time on the public mind, to which all must, more or less, conform, who aspire to please, or hope to be received in good company. Never having seen a specimen of Greek Architecture, except in museums, it is not without considerable hesitation that I venture to offer a few sentiments upon this abstruse subject. I have carefully perused the various writings which bear upon it, especially that very learned volume, in which Mr. Penrose gives us the result of his investigation of the various delicate curves, which form the principal lines of certain Greek buildings, erected during the most refined period; he states that "the amount of curvature is so exquisitely managed, that it is not perceptible to a spectator, or at least not until the eye has been educated by considerable study founded on knowledge of the fact." In another part of his work, he informs us that "in some Greek temples, although erected during the very best period of Greek art, the columns have no entasis whatever;" on the authority of Mr. Penrose, therefore, it appears pretty certain that Greek architects did not invariably bend long lines that were intended to appear straight.

In this country, thirty or forty years ago, when scarcely any but Grecian buildings were tolerated, it would have been deemed *barbarism* to have curved a line in a purely Greek edifice. At that period, a celebrated architect gave his mason the drawings of a Doric portico, to be executed during his absence on the continent; no intimation was given that the columns were either to be "swelled" or straight, and they were consequently executed with a *very slight* entasis; so slight, that it was not observed by the architect when he returned, until he had inspected the work several times; but when discovered, it was pronounced to be vulgar, unarchitectural, and the sight even of anything so monstrous could not be endured; and notwithstanding the building was finished, the mason was

obliged, at his own expense, to re-work the columns and their flutings, to make them perfectly straight from top to bottom.

As soon as Mr. Inwood had made out the necessary working drawings for the lower portion of St. Pancras Church, he left the work in charge of his two brothers, and proceeded to Athens, in order to ascertain many details of the Erechtheum, more correctly than were given in Stuart's work, or to be found in the Elgin collection at the British Museum. When he returned the building had reached the height of the entablature, and, on the authority of Stuart, the Ionic *antæ* were made parallel and upright; that is, without either diminution or entasis. The architect having ascertained that this was not in accordance with the antique example, had the *antæ* all re-worked after they were fixed, to diminish the upper part, and give them the proper entasis.

The outer lines of a swelled column represent the frustrum of a parabolic or hyperbolic curve; which is amongst the most perfect of the geometric forms, and may be an improvement upon the straight lined column; but in constructing a large obelisk, much consideration is required before we depart from the simple straight lined form, under the idea of improvement. I am aware of the difficulty of overcoming prejudices in favour of long established practice, in matters relating to art or science; nevertheless, optical effects are now well understood, although some of them may not be easily explained; and the rules of perspective are proved to be perfectly in accordance with nature, and founded upon the strictest mathematical principles; with such aid, we may arrive at far more satisfactory conclusions respecting the appearance of lines variously situated, than can be adduced from opinions founded on some preconceived notions of right or wrong; and which are generally problematic statements without proof.

In constructing an obelisk, is it advisable to make its outlines positively crooked, under the idea that they will then, and only then, appear straight. Or can an object that is decidedly right, true, and correct, under any circumstances look wrong, false, or incorrect. Is it not probable that our sense of vision may be deceptive; that we may receive impressions on the imagination that are not real, and such as may require very attentive consideration; or we may fall into erroneous conclusions. A line that is to represent straightness, or the shortest distance between two points, being intentionally curved, cannot, under any circumstances, represent to the eye correctly that which is intended. Whoever trusts unnecessarily to the accuracy of his eye, and sets positive rules of art at defiance, will, at all times, be liable to make great mistakes. Vision, optical effects, and especially the true principles of perspective, judiciously applied to works of art, tend invariably to perfection. To deviate from them, in ever so slight a degree, is to depart from truth; to pass by the substance and follow the shadow. It is like attempting to improve the multiplication table; or to depress or swell some portion of a circular object, with the view of making it look rounder.

By a similar mode of fallacious reasoning, a long architectural elevation, such as one side of a street, viewed from the opposite houses, ought to be made hollow on the top of the parapet, that is, a little higher at each end, without the least symptom of an angle, just opposite the observer, where it appears to be the highest part. As far as appearances are concerned, this apparent declination towards each end is not altogether fictitious, although, in some respects, it may be termed delusive, for if a straight ruler or string be held up, stretched between the two hands, so as to form a right line, the tops of the houses will exactly coincide with the edge of the ruler or tightened string. Thus, the string being held horizontally, or parallel to the tops of the houses, will affect the eye of the observer precisely in the same way; and the string itself will appear to bend downwards at the ends. This may be demonstrated with mathematical precision, by the doctrine of similar triangles. The same train of argument applies equally to a pilaster built with parallel and perpendicular sides;

as we frequently find in Roman and revived classical works, which is generally considered to appear broader at the top than at the bottom. In this case the spectator allows his imagination (not his eye) to deceive him; the actual appearance (not the measurement) of the breadth of the pilaster at top is smaller than the bottom. Every portion of the pilaster upwards is seen within a smaller visual angle than an equal portion level with the eye; therefore the higher we look, the narrower will be its appearance, until ultimately the parallel lines will altogether disappear and vanish in the zenith, or point precisely over our heads.

Artists may possess much practical knowledge of perspective, and be capable of drawing very clever architectural subjects, either views from nature or imaginary designs, and yet be unacquainted with the true principles of the science. Such artists assert that the rules of perspective are not to be depended upon, and that if strictly followed they occasionally produce unnatural representations; as an instance, they adduce the case of a very high, straight-lined parallel tower, which will, unquestionably, appear in nature to diminish upwards, in every respect the same as a perpendicular pilaster; to represent this object, according to the rules of perspective, we have to make the tower as broad at top as at bottom, and this will be strictly correct. A photograph, if properly taken, would be the same; but if the photographic apparatus be left to one ignorant of the correct mode of placing the instrument, the lines which are perfectly upright in the real object, will be represented in the photograph converging upwards or downwards; and such defects are ignorantly attributed to faults of the lens, or of the process generally. Upright lines in a building will all correspond with the plumb-line, whereas, if such lines are made to converge in a picture, they will not bear the test of the plumb-line; consequently, such a mode of representing the outlines of perpendicular edifices must be false, and unlike the real object.

Mr. BELL, Visitor, asked permission to read some observations.

In recurring to the subject of the last meeting, it gave me no little pleasure to find my ideas in regard to "Entasis and curvilinear treatment applied to the Obelisk" so favourably received by the Institute. The views of the Rev. Mr. Burgess, in his learned and admirable Paper, and the remarks of Mr. Tite and Mr. Bonomi and others, while conveying much most interesting information, were also very gratifying to me in this respect.

An observation, however, which was made by Mr. Hussey, the Chairman on that occasion, calls, I think, for notice, in regard to an objection which has been occasionally raised to obeliaks, in that some resemblance exists between them and a manufactory chimney. Of course one must be careful how one admits comparisons of this nature to dim the lustre of fine features of Art, inasmuch as there are few of these that may not in some degree be travestied or paralleled by inferior objects. The fact, however, that many of our tall manufacturing chimneys *do*, in some degree and in some points, resemble the obelisk, does, I think, point to a more careful treatment of that feature of Architecture now than heretofore.

Firstly, as to site, therefore.—I should doubt the advisability of erecting an obelisk in the immediate vicinity of an assemblage of manufactory chimneys; and it is pretty evident, I think, that an obelisk form which might be admirable in a park, or as an ornament in a grand "place" in a metropolis, might be far from judicious in the midst of a manufacturing town.

Secondly, also, the above fact points to obeliaks being monolithic.—If it were well at any time that an obelisk should have been *built*, that is, made of many stones, it is not so, I think, *now*. Chimneys are built of many bricks. The character of *construction* is evident in *them*. But an obelisk of record and endurance should be in *one stone*. There is a unity about the very idea that has of itself a world of vigour and poetry about it.

Thirdly.—The same fact points, I think, to the utmost possible degree of *refinement* being applied to this feature, which I conceive can be only afforded by a treatment analogous to that by which the Greeks produced such perfect effects in their features of Architecture, that is, by a curvilinear treatment of a compensatory character applied to lines otherwise straight. And it may be further seen, that the adjustment of this is so delicate, that there would be a vast advantage (in this as well as other respects) in an obelisk being a monolith. The joints, in case of its being built, would in some degree embarrass the perfection of the execution of the contour and its effect when executed, and of course the permanence of the contour of the work would be less. If the Parthenon could have been a monolith—the whole edifice! with what comparative ease and in what perfection we might now view those delicate linear adjustments applied by the tasteful hand of the Greek more than 2,000 years ago! In the case of such a building as the Parthenon, of course a monolith treatment was out of the question. With an obelisk, even of a size superior to any of the Egyptian examples, I believe it now quite possible.

In reference to the point raised by Mr. Hussey, I have myself not the least apprehension that an obelisk appropriately placed, monolithic (and say 100 feet high, of British granite), and gifted with all those refinements of contour that would be supplied by the architects of this country, and perfectly polished, so as to emphasise its lines against the sky with the clearest precision—I say I have in my own mind not the least apprehension that this feature, thus perfected, would have any analogy in expression with any common feature of every-day construction.

As a problem of pure form, the obelisk, thus considered, appears to afford an exquisite and peculiar subject for the exercise of Science, Taste, and Art, and the more so from its simplicity and isolated character. I have heard say (although of course I do not venture any opinion on the subject) that it is not a very easy thing to do anything really *new* in Architecture. If so, and if there does exist a special and peculiar feature in this art that *has* been overlooked and left incomplete up to this time, the opportunity it affords in this respect may be held to be proportionably valuable. And if this problem of a perfected obelisk has indeed been left untouched and unsolved since the time of the Pharaohs, for British architects to do out of British granite, why, I say, to me it appears a *glorious opportunity!*

As I have alluded to a monolith of 100 feet, I would further say, that from enquiries from the best sources, I find that this is not probably the largest size that could be yielded by British granite, but that there would be a good prospect that one of still larger dimensions (say of 120 feet) could be obtained. This in size would exceed, I believe, any of the Egyptian examples. It appears to me that the working out of such a problem on such a scale would be one of world-wide interest, and if successfully executed and erected by the architects and engineers of this country (of which there cannot be any doubt, if it were undertaken), that it would be a world-wide triumph. It is, however, merely in the light of an abstract question that I last meeting submitted this subject, and in response to the kind invitation of this Institute, and it is in the same spirit that I allude to it now.

Mr. LOCKYER, Associate, said he was of opinion that the erection of a single obelisk was nothing more than a perversion of taste and a travesty. The Egyptians always placed them in pairs, and never separately. The Romans only had employed them singly, as memorials of their conquests, and they had in like manner misapplied the column, which they were not content to use merely in its natural position, but surmounted it by a statue. He differed from Mr. Kerr on two points. In the first place, he believed (in spite of numerous hiatus) that the use of the obelisk could be traced, as Mr. Burgess had stated, up to a date anterior to the time of Moses. In the second place, he considered Mr. Kerr to be very wrong indeed in the view which he had taken of the learning of the

time of Moses, and any one who had read the Books of Moses would, he believed, agree with him in that opinion. The prophet was described as skilled in all the learning of the Egyptians, and Egypt must have been a highly populous and cultivated country, having indeed supplied the neighbouring countries for seven years during the famine which prevailed. Egypt must, in fact, have been teeming with population, and its people far advanced in the knowledge of agriculture; besides which, it was recorded that the Israelites were building "treasure cities" for the Egyptians. Mr. Kerr's idea was, that the Israelites had overpowered the Egyptians, but all that was on record went to prove that the Israelites increased and multiplied in the land, but that they had to flee before the Egyptians. It then appeared that a new king arose who knew not Joseph, and there was every reason to believe that the country was conquered by an Ethiopian, or some southern race.

Mr. J. W. PARWORTH, Fellow, referring to Mr. Smith's paper, said that he had appeared to ask the members not to believe the evidence of their own sight, but on the contrary, to believe that the top of a pilaster was wider than the bottom of it.

Mr. SMITH said he had merely asserted that the eye was not always to be depended upon; adding that the statements in his paper could be demonstrated on mathematical principles.

Mr. DONALDSON, H.S., F.C., regretted that he had not been present at the last meeting, but he had read the papers then brought before the Institute, and he had now the advantage of having heard the remarks of Mr. Kerr. He could not help stating that he considered there were many fallacies in those remarks; for Mr. Kerr, indeed, had hardly looked upon the question as involving any broad principles whatever. The works of the Egyptians did not appear to create any wonder in the mind of Mr. Kerr, as having been produced by merely physical agency; but to him (Mr. Donaldson) the wonder seemed to be that the Egyptians could have achieved so much by physical force alone, and he was sure that on reflection Mr. Kerr would recall the idea of disrespect to the Egyptians. It was a vast operation to obtain the large stone necessary for an obelisk from the quarry (where the ground was low) and to set it up in its proper position. Many of these quarries were from 30 to 50 feet in depth; and without mechanical aids it was a most difficult and troublesome task for the Egyptians to extract these huge blocks of stone, to get them to their sites in front of the temple, to unship and reship them at each cataract, and transport them considerable distances overland, and then to raise them on to blocks of granite ten or twelve feet high. The works of Mr. Bonomi showed that the anxiety of the Egyptians was not so much directed to the perfection of their obelisks as works of art, as it was to their magnitude. With regard to the erection of obelisks in this country, it would be very difficult to get blocks of the necessary size. It was suggested at the last meeting, that boulders adapted for the purpose might be bad; but these large boulders would generally be found to be fractured to a great extent, from having been rolled over many miles in their glacial transit, and sometimes from having fallen over precipices. He did not think they could be got in Scotland. Referring to the cost of removing, and erecting the obelisk in Paris, he did not believe that operation had cost even the £30,000 named in the Parliamentary Paper; and Cleopatra's Needle could be brought over and erected here for a similar if not smaller sum. Mr. Kerr considered that the refinements of Greek art were entirely matters of taste; but he, on the contrary, believed that the Greeks had observed nature with so much minuteness, that they were able to perceive what was necessary to correct any optical delusion; and accordingly, contrived to make that look natural, which, if placed naturally, would look unnatural. [Mr. Kerr remarked that he merely said that entasis would be at once observed by an educated eye.] Monuments were not erected for uneducated eyes. Mr. Kerr appeared to congratulate the country for not having brought over Cleopatra's Needle; but

he (Mr. Donaldson) should have wished to see the generosity of the nation exercised in the expenditure of a few thousand pounds on such an object, and to have seen it raised in London on the system of M. Lebas, without the use of the forest of timber required on Fontana's system, which Lebas had shown to be unnecessary. There could be no possible objection to erecting obeliaks in this country: on the contrary, it was desirable to prove that our quarries could produce, our scientific men remove, and our artists erect, a fine monolith with such inscriptions upon it, as should be more significant than those of the Egyptians. Why should not they incise on monuments of this kind the names of their great generals,—and trophies or emblems, naval or military,—in such a manner as to meet with general acceptance? The main question raised by Mr. Burgess was as to the propriety of erecting obeliaks at all in the present time. The feeling of the age was too utilitarian, and the general opinion was, that in erecting monuments or trophies they should not be merely such as to please the eye, but they must also have some useful purpose. This was a degradation of the object. In the noblest times of antiquity any great event, whether a victory in war, or the clearing the hill for the Trajan Forum, was commemorated by a triumphal arch or column, or similar structure. The Romans did not require that this should be useful in its character, but it was made to be a noble trophy, costly in its material, elaborate in its design, and representing the arts of the country and the character of the man whom it was intended to commemorate. This was the spirit in which such works ought to be carried out, and he could not but regret that the £100,000 set aside to erect a trophy of the Battle of Waterloo had not been so expended; a sum which would have produced a splendid monument, crowned with sculpture, and in every respect acceptable to architects and men of taste. He fully concurred with Mr. Burgess in thinking that monolithic obeliaks of graceful form (such as that designed by Mr. Bell) would be appreciated by the public, and would carry conviction to the minds of all as one of a class of memorials most proper for great events.

Mr. GEORGE FOGGO, Visitor, said as the finest qualities of a man of talent would be wasted unless he could give expression to them, so a fine monument that could not speak to posterity would be equally looked upon with indifference. Inscriptions of some kind were essential to the effect of obeliaks as monumental works.

Mr. JOHN BELL, Visitor, stated that Mr. Freeman (well known as a stone merchant) had informed him there was not the slightest doubt that monoliths of 100 feet long could be obtained at Lamorna and some other of the quarries of Cornwall. He understood, however, there would be some difficulty in getting such blocks in Scotland.

Mr. LOCKYER thought an inscription would be entirely lost upon an obelisk of 100 feet in height, especially on granite.

Mr. DONALDSON said that a single name,—such as “Wellington,”—could be easily and effectively inscribed upon a granite obelisk six or seven feet wide at the summit.

Mr. JOHN BELL concurred in thinking there would be no difficulty in inscribing granite obeliaks.

Mr. DONALDSON (in reply to an inquiry) mentioned that Fontana had been paid by the timber required for the erection of the obelisk at St. Peter's, and had a pension of 1000 crowns a year besides for life.

Mr. M. DROBY WYATT, H.S. said that in the absence of Mr. Burgess, one or two points mentioned by that gentleman, and now controverted, should be defended. He agreed with Mr. Lockyer as to the state of the Egyptian arts in the time of Moses, a well defined and universally accepted era; and his records of that period corresponded with the character of the monuments still existing. Mr. Kerr's impressions, unsupported by corroborative evidence, ought not to be allowed in any wise to disturb the conclusions which those, who had investigated the subject, had agreed to among

themselves. All the chronologists agreed, within the limits of one or two centuries, in the antiquity to be ascribed to the races of the great kings of Egypt,—extending, as they did, for several centuries previous to the epoch of Moses. The only dispute amongst them referred to the duration of the respective reigns of those monarchs, and to the exact range of time to be allotted to the eighteenth and other dynasties. Any person, who examined Egyptian sculpture, would find that as it receded in date it was more perfect, and that the earliest of all was the most perfect,—leading at once to the conclusion that the highest state of cultivation existed at the earliest historic period. Mr. Kerr ascribed to Mr. Burgess opinions on the subject of the supposed mechanical powers possessed by the Egyptians, which the speaker had not gathered from Mr. Burgess' paper; and when Mr. Kerr asserted that the Romans had accomplished more difficult feats than the Egyptians in raising obelisks, it should be remembered that the Egyptians must have lifted these monoliths over and over again, to get them out of the quarries and over the cataracts (having carried them in one case no less than 600 miles) to their destined site; which was a far more difficult operation than any the Romans had performed; since these huge blocks, when quarried in the rough, must have weighed probably twice as much as at present, or when the Romans removed them. It appeared also to be an error to deny that the Romans had either made obelisks for themselves, or caused them to be made, since of the twelve enumerated by Mr. Burgess, no less than four would appear to bear the names of Roman emperors, and to be overt imitations of the more genuine and ancient ones. Mr. Kerr considered the Egyptians were an unpoetic people, but he (Mr. Wyatt) considered that their mythology abounded with poetry. They were the first nation to have painting and sculpture, and a complete system of hieroglyphics; and although we had not much of their writings to refer to, enough still remained to testify that they were not wanting in the poetic element. With regard to the cost of removing Cleopatra's Needle, his friend Mr. Owen Jones and himself had endeavoured to persuade the directors of the Crystal Palace to undertake the task of bringing it to England. Letters were received, almost in the form of tenders, and from very responsible persons, stating that they were prepared, for some such sum as £10,000 to £15,000, to make arrangements for bringing it over;—so that he thought the sum of £90,000 a very exaggerated estimate. (Mr. HUSKY repeated that he had understood this was the cost of the Paris obelisk). With regard to entasis, he did not think the Greeks were wrong. Every artist must acknowledge that great subtlety in the treatment of lines was necessary to produce refined effects; and, except in very large works, distortions would arise unless compensations were made for the optical effect of straight lines impinging upon curved lines, and upon one another. The same principle had led the Gothic architects to give entasis to their spires; and the rules governing the subject resembled those of the contrast of colours. It was not in the case of single lines, but only where two lines met together, that it was necessary to resort to corrective curvature in parts.

THE CHAIRMAN, Mr. Scoles, V.P., expressed his opinion that in polishing obelisks, and especially the lines of the inscriptions, the Egyptians had surpassed the art of the present day. He had never heard the cost of erecting the Luxor Obelisk in Paris stated at more than £24,000. He added that there was a remarkable identity in the line of inclination of all the Egyptian obelisks which had been actually measured, as might be observed on one of the diagrams exhibited, which he had drawn out.

Mr. J. W. PAPWORTH observed that the whole gist of the question between the gentlemen who had spoken and Mr. Kerr was, that, at some time or other, Moses was in Egypt; but as to when that was, no one had more than a guess to offer.

NOTES ON THE ASSUMED USE OF CHESNUT TIMBER IN THE CARPENTRY OF OLD BUILDINGS.

By WYATT PARWORTH, Architect.

Read at the Ordinary General Meeting of the Royal Institute of British Architects, June 14, 1858.

THE reason for my troubling you with the following remarks is twofold—first, that in the course of writing the paper on fir, which you kindly received at the commencement of this session, the controversy on chesnut and oak woods was continually brought before my attention in the works which there was occasion to consult; and secondly, that the timber of edifices, mentioned in several articles of the Dictionary prepared for the Architectural Publication Society, was often stated by the writers to be that of chesnut,—the sweet or Spanish chesnut,—the *castanea vesca* of botanists. Having made several enquiries, and having heard the result of others, I am inclined to believe that chesnut was *never used for timber*, at least in the large works in which it is generally attributed to have been employed. This may appear a bold assertion to those who have taken notice of the constant repetition of the word chesnut, but if you will listen to the grounds for my opinion, probably the subject will appear an interesting one in itself; and such statements as I have been able to collect, may suggest other conclusions than those usually received upon the use of this wood.

Harrison, writing in the time of Queen Elizabeth, only mentions the use, in times past, of willow, willow, plum tree, hardbeam,* elm, and oak. Yet writers,† for a long succession of years, even whilst quoting the above passage, and others from this author, declare that chesnut timber was largely used in earlier times for building.

The confusion appears to have commenced with Evelyn, or about his time. In the *Sylva* ‡ he states that "The chesnut is, next the oak, one of the most sought after by the carpenter and joiner. It hath formerly built a good part of our ancient houses in the city of London, as does yet appear. I had once a very large barn near the city, framed entirely of this timber; and certainly the trees grew not far off, probably in some woods near the town; for in that description of London, written by Fitz Stephens, in the reign of Henry II, he speaks of a very noble and large forest which grew on the boreal [north] part of it." "If the timber be dipped in scalding oil, and well pitched, it becomes extremely durable, but otherwise I cannot celebrate the tree for its sincerity, it being found that, contrary to the oak, it will make a fair show outwardly when it is all decayed and rotten within; but this is in some sort recompensed, if it be true that the beams of chesnut tree have this property, that, being somewhat brittle, they give warning and premonish the danger by a certain crackling." Many writers, copying each other, have misquoted the above cited passage in Fitz Stephen, and declare that he states that the Spanish chesnut grew in great profusion in the forests near London.

The point at issue, the use of chesnut timber, was mooted so early as the years 1769 and 1771, in the pages of the *Philosophical Transactions*,|| when the Hon. Daines Barrington took up the question. He also writes, "Since you sent me the specimen of supposed chesnut, which was

* The hornbeam, or hardbeam.—Miller: *Gardener's Diet.* † Hunt, *Tudor Arch.* p. 89; Hunter's edit. of Evelyn's *Sylva*, 1776, p. 159; and others ‡ p. 166-8 of Hunter's Edit. 1776. § Vol. 59, p. 93, et seq.

taken from the old hall of Clifford's Inn, I have been at some pains to examine into the authorities for the prevailing notion with regard to this being an indigenous tree. I remember the having once been present myself when a wager on this head was won; it being supposed that a small specimen of a beam, from a very ancient house in Chancery lane, was of this wood, which turned out to be nothing but common oak. When you placed your specimen from Clifford's Inn in my hands, I knew it immediately to be only the common oak." "Though so much hath been said of late with regard to the excellence of this wood for building, I cannot upon enquiry, find that it is greatly prized for this purpose either in Spain, Italy, or the South of France; but it is chiefly valued for the fruit.*

"Ducarel," he continues, "in his *Anglo-Norman Antiquities*, p. 96, endeavours to prove that Old London was not only built with chestnut timber, but that there still continues a large tract of chestnut woods near Sittingbourne in Kent. I found on examination of these woods that the chestnuts are planted in rows about five yards distant from each other, without any trees scattered about, proving that they are not of natural growth. They are probably of the time of James or Charles I.

"We are told that the roof of Westminster Hall, Boston Church, and many others consist of this wood; not because any one hath found it to be so on examination, but because there are no cowbys upon such roofs. Sometimes also, to account for spiders not harbouring in them, it is supposed that the timber is not English, but Irish oak. As this insect is known to subsist chiefly on the small flies which it surprises in its nets, the consequence is that it will no more be at the trouble of spreading its web where flies cannot be expected, than a fowler will lay his nets in a place where there is no resort of birds. No fly is scarcely ever to be seen but where there is a good deal of light and sunshine, consequently a wide wooden roof is the most improper places that a spider can lay its snares in: a whitewashed place would be selected by them in preference to a wainscoted one."

Ducarel, in reply,* says, "In my *Anglo-Norman Antiquities*, I had observed that many old houses in Normandy, when pulled down, are found to have a great deal of chestnut timber about them; as there are not any forests of chestnut trees in Normandy, the inhabitants have a tradition that this timber was brought from England. "Rudhall, near Ross, in Herefordshire is built with chestnut which probably grew on the estate, although no tree of the kind is now to be found growing wild in that part of the country. . . . The old houses in the city of Gloucester (as the Rev. Mr. Crawley informs me that he has often been assured) [†] are constructed of chestnut, derived assuredly from the chestnut trees in the forest of Dean. In some of the oldest houses of Faversham is much genuine chestnut as well as oak employed. In the nunnery of Davington, near Faversham (now entire), the timber consists of oak intermingled with chestnut. And the great beam of chestnut which supported the leads of the church tower at Faversham when it was lately pulled down, was found rotted for many feet at the extremity, and had as it were a mere shell of sound timber remaining about it."

Another writer, Mr. J. Thorpe, follows, and declares, that during the repairs of "the old house at Nettlesed, in Stockbury [near Maidstone, in Kent], a main girder, besides other timbers, were pronounced by the surveyor and the builder to be chestnut. Cowsted, in the same parish, is entirely of the same wood. The curious roof of the large hall of the mansion house at Lesnes [near Erith in Kent] is of chestnut, which no doubt was felled in the abbey wood there."†

Hasted follows to the assistance of Ducarel, and states, "The ancient Norman buildings [he means buildings in Normandy] are mostly of this wood, which in all probability was fetched from this

* Vol. lxi. p. 136.

† A description of Lesnes is given in the *Archæologia*, i. p. 44.

country. Most of the stone wherewith our monasteries and buildings of such sort were erected came from Normandy. This seems to have been a mutual traffic for some centuries between the two countries." "Oak timber is so entirely different from cheenut in the rings and spaces, which appear when cut transversely, that it is impossible to mistake the one from the other." Barrington, in replying to the three objectors to his views, says, "I have already said that I am willing to leave the point in controversy, upon what hath been advanced on the one side and on the other." It is curious that excepting the one observation about "the impossibility of mistaking the one wood for the other," these four writers do not attempt to describe the two woods.

In a work of a later date,* it is stated that "many pieces of wood found in the old buildings of London, and supposed to be Spanish cheenut, were examined by Mr. Knight and found to be forest oak." Yet still the assertion is made of the use of cheenut.

Before I attempt to describe the difference between the two woods, reference should be made to some of the other buildings in which it is commonly reported that cheenut is used. The most important of these is the roof of Westminster Hall, which, as you are aware, was put up between 1306 and 1309, time of Richard II. It is reported that about the year 1600, and for a century before, the English had exported vast quantities of oak from Ireland; and from a statement given in some of the scientific journals for 1856,† it would appear that Irish oak was appreciated at a still earlier epoch, for "A record in St. Michan's Church, Dublin, which is verified by 'Hammer's Chronicle' in the library of Trinity College, states that the faire greene or commune, now called Ostomontowne Green (now Oxmorton), was all wood, and hee that diggeth at this day to any depth shall finde the grounde full of great rootes. From thence, anno 1098, King William Rufus, by license of Murchard, had that frame which made up the roofes of Westminster Hall, where no English spider webbeth or breedeth to this day." In a treatise on Naval Architecture, by Nicholas Witaeu, a Dutchman, in 1671, it is stated that the Hollanders were plentifully supplied from Ireland with oak, for the best and toughest of their work in shipbuilding. Of course the above extract does not allude to the present roof of the Hall; but in support of the probability of its being of oak as now generally asserted, and not cheenut, "Tradition," says Hayes,‡ "gives the Shillela oak [a district in the county Wicklow] the honour of roofing Westminster Hall and other buildings of that age: the timbers which support the leads of the magnificent chapel of King's College, Cambridge, which was built in 1444 [began, he should have said, as it was not vaulted till about 1515], as also the roof of Henry VIII.'s [VII?] Chapel in Westminster Abbey, are said to be of oak brought from these woods, and I think it by no means improbable, that the superior density and closeness of grain which is the character of the Irish oak, particularly in high situations and a dry soil, as may appear by comparing its specific gravity with that of other oak, added to the inattention of the Irish at that time to the article of bark, which permitted their oak to be felled in winter, when free from sap, might have induced the English architects to give it the preference in such material works; and it must be allowed that the present unimpaired state of these roofs, after so many centuries, seems very well to warrant this conjecture. It is generally understood that a sale was made of the finest timber of Shillela which remained in Charles II.'s time, into Holland for the use of the Stadt-house and other buildings, constructed on piles driven close together to the number of several hundred thousand. In 1669 William Earl of Strafford furnished Laurence Wood of London with such pipe staves, to a great amount, at £ 10 per thousand, as are now sold for £ 50, and are only to be had from America. The year 1692 introduced into Shillela that bane of all our timber, iron forges and furnaces . . . and

* Transactions of the Highland Society, v. 256.

† Builder Journal, xiv. p. 53.

‡ Practical Treatise on Planting, &c. 1794, p. 110.

it is inconceivable what destruction they must have made in the course of twenty years, which was the term of their contract."

Another authority for the present roof being of Irish oak is Barclay,* who, in his *Icon Animorum*, published in 1614, and dedicated to Louis XIII. of France, mentions that the timber of Westminster Hall was brought from Ireland. Rees' *Cyclopædia*, article Westminster, contradicts its being of Irish oak, but states it to be of chestnut from Normandy; and Mr. Nightingale, in the *Beauties of England and Wales*, declares that it is built of chestnut supported by ribs of oak. The Irish oak, however, was employed by Charles V. (who reigned in France as cotemporary with our Richard II.) for the roof of the library of the Louvre; and it is so stated by L'Abbé Sallier, in the Introduction to the great catalogue of the Bibliothèque du Roi (of which the Louvre library was the commencement), and this observation has been copied by later writers. Consequently it may be inferred that Irish oak may have been used at Westminster. Of course I do not claim the merit of first making these historical facts known, but as they have laid dormant for the last twenty years at least, their revival may perhaps assist in preventing the future repetition of the common assertion of the "chestnut roof," even without the authority of Britton and Brayley,† who state that "the entire roof is of oak;" and Tredgold, in the first (1820) edition of his *Carpentry*, informs us "that the roof of King's College Chapel at Cambridge may be cited as an example of the durability of chestnut in a dry state: also the roof of the church of Notre Dame at Paris. Rondelet, however, observes, that several old buildings near Paris, of which the timbers were supposed to be chestnut, were examined by Buffon and D'Anbenton, who found the pretended chestnut to be a variety of oak; and it is probable that a closer examination will prove the roof of Westminster Hall to be of oak." In the second, or 1828 edition, is added in a note, "After the first edition was published, the author examined some specimens of the rafters, &c., and found it to be of oak, with a fine kind of *septa*; December 1820." It is only this year that I was strongly assured that the whole roof was of chestnut. The box which I am enabled to exhibit by the kindness of Mr. J. W. Hiert is made out of this supposed chestnut; as is also the set square, lent to me by Mr. Rowe of Cambridge.

The roof of St. Nicholas' Church, Great Yarmouth, is stated to be of chestnut. I had hoped to have been able to have ascertained this satisfactorily last year, whilst staying in that town, but having left the examination of the church until the last day of my stay, I found, when arrived in the belfry, that lights, as well as much courage, were wanting to grope amongst the old timbers, where shortly before a lad had stumbled and been precipitated through the boarded ceiling on to the floor of the church. Whilst there I obtained the accompanying piece of what all the local carpenters call chestnut; it formed part of a standard to a former gallery, put up in 1640. The grain is very peculiar: but it is oak, not chestnut, and closely resembles a panel I have seen labelled as "English oak."

Brandon, in his valuable work on *Timber Roofs of the Middle Ages*, says, "they are all of oak or chestnut." The roof of Chartres Cathedral, burnt in 1890, was said to have been of oak and chestnut;‡ In the description in the *Monasticon*§ of Castel Hymel, or Fineshed Priory, in Northamptonshire, there is an improvement on the misunderstanding: "In the granary lately taken down the beams were of *horse-chestnut*."

Of another well known structure, still said to be roofed with chestnut,§ it is reported that "the timber used for the scaffolding, &c., and for the upper roof of the chapel [of King's College], seems to have been given to the college by Henry VII. and his executors, over and above the £1000 before mentioned, for the college paid only for felling and carriage; it was brought from the Wethersfield

* *Gentleman's Magazine*, June, 1837, p. 370, 368.

† Westminster Palace, 1836, &c. p. 441.

‡ *Builder*, xi. p. 693.

§ Vol. vi. Part I., p. 449.

§ *Le Keux, Memorials of Cambridge*, ii. 43.

Park, Poule Park, Walden Park, Ashden Hays, Bardefield Park, Broxstey Park, all which are in Essex, and some from Carlyng (Catlige) in Cambridgeshire; the timber of the roofs I believe was chiefly from Wethersfield." If this be correct, Hales, before quoted, is wrong in stating that it was obtained from Ireland, and tradition is again worthless; but did the county of Essex ever grow chesnut trees for timber? I must regret that I have had no opportunity of inspecting the roof timbers of this chapel, so as to satisfy myself.

Two pieces of wood called chesnut have been kindly forwarded by Mr. Rowe, taken out of old buildings at Cambridge, both of which I submit are oak; as well as another piece sent by him from an old house at King's Stanley near Stroud, lately pulled down—it is a fine specimen of an oaken beam between 250 and 300 years old. Also another piece of a moulded beam, taken out of the principal gateway of Trinity College, Cambridge; it was situated in Sir Isaac Newton's study, being the first-floor room over the gateway. This is also oak.

Besides having been used for beams, it is stated,* that at the end of the sixteenth century *wainscot floors* were much in use, and in some manor houses, *chesnut floors*, as at Cotele in Cornwall, an ancient house; and also at Mount Edgecumbe in Devonshire.†

I will now submit some specimens of the actual woods under discussion. The first is a veneer of chesnut, as sold by the fancy-wood merchants. Mr. Ashpitel (whose absence on this occasion is to be regretted) kindly obtained for me specimens of oak and of chesnut, *both grown in the same wood*, in Kent, which suffice not only to show how close is the resemblance between the two woods when young, but also how the difference between them is to be observed. As these small pieces, however, could hardly be considered sufficient, I inquired for some larger specimen amongst the timber-yards of the Metropolis, and when about giving up the search in despair, obtained a board, which being 21 inches in width, will show the grain clearly. There are also some other specimens to which I will refer presently.

How is chesnut, then, to be distinguished from oak, and is it at all serviceable as a timber?

One of the practical suggestions that has been made for discovering the difference, is given in Nicholson's Dictionary of Architecture, who states that it may be found by driving an iron pin or nail into the woods while fresh: in the oak a black stain will be produced, but not so in the chesnut. This observation is repeated in another work; and they are the only two in which I have seen it named. I tried the experiment with the two fresh pieces sent me by Mr. Ashpitel, and you will perceive that both of them have the stains; the two in the oak showed in two days, and of those in the chesnut, one showed in two, and the other in four, days time. Another suggestion is to weigh a portion of the wood in question. Dry chesnut, according to Tredgold, "weighs from 34 to 38 lbs. per cubic foot, whereas dry English oak weighs generally from about 50 to 55 lbs. One dry specimen from an old oak tree weighed 39 lbs., or about the same as chesnut." On weighing the piece of wood from King's Stanley, above mentioned, I found a cubic foot of it would weigh 53 lbs.

A third idea is rather more laughable than serious, and has already been adverted to; it is one, however, which, from its being "a wise saw," ought not to be neglected, especially as the "spiders" are so often put forward as better authorities than ourselves in the settlement of what is oak or

* Brown's Domestic Architecture, p. 154.

† Since reading these 'Notes,' my friend Mr. W. Darnant of Plymouth, accompanied by a gentleman well versed in the nature of timber, has kindly examined for me the presumed chesnut floors at Mount Edgecumbe; they pronounce them to be "of what at the time of laying was, young oak—excepting that in two or three small window recesses, and in the margins to the hearths, chesnut had been employed. There were also two or three short pieces of chesnut in the floor of the drawing room, but they appeared to have been used in repairs. The floor certainly was not chesnut, nor was that wood employed at all in the other joinery of the house."

chesnut. In addition to what has been said in the earlier portion of this paper, you will find several remarks under the heading of "Spiders and Irish Oak," in Notes and Queries for last year (p. 208, &c.) 'thus, in Pointer's Oxoniensis Academia, 1749, is the following, in his account of the curiosities of Christ Church College. The roof of the aforesaid hall is remarkable on this account, that, tho' it be made of Irish oak, yet it harbours spiders, in contradiction to the vulgar saying. Tho' I am apt to think that there may be some pieces of English oak amongst the Irish; or else probably that particular smell that proceeds from that sort of oak, and is perhaps so distasteful to that sort of vermin, may be spent through age, or disguised by smook, and so that common saying may stand good still.' It is also shown, p. 293, that the spider 'has *no dislike* to fixing its web on Irish oak;' also that 'no spider will hang its web on the roof of Irish oak in the chapel or cloisters at Winchester;' and 'chesnut is said to possess the same virtue.' 'The cloisters of New College, roofed with chesnut,' are free from spiders; 'the choir of St. David's Cathedral is stated to be roofed with Irish oak, and there are no cobwebs, although they are plentiful enough in other parts of the cathedral;' and lastly, that 'a fine old roof at Turner's Court, in the parish of Cold Ashton, Gloucestershire, four miles from Bath, is perfectly free from cobwebs, and is said to be of chesnut.'

The qualities of chesnut wood, as required to be known by us, are thus admirably described by Selby, in his History of British Forest Trees, 1842:—"The only particular in which the chesnut exhibits a decided inferiority (to the oak), is in the quality of its timber, which, unlike that of the oak, which gains strength and durability by age, begins to deteriorate at heart, ere the tree has passed much beyond the first half-century of its growth;" "By some the chesnut has been considered as indigenous to England—the more general opinion, however, is that it is not a native, but was introduced at a very distant period, probably by the Romans. The belief which so long and so generally prevailed, and indeed, we may add, still partially exists, that the roofing and main beams of many of our ancient buildings and houses were framed of the chesnut, naturally gave rise to the idea that a tree so abundant and generally distributed as it must have been in former ages, must also have been of indigenous growth; for this supposed chesnut timber, we may remark, is not confined to buildings in the southern and midland districts of the kingdom, but is also found in the northern counties, and even in Scotland, for Sir T. Dick Lauder, apparently not aware of the discoveries of Daubenton and others, instances the roof of the parliament house at Edinburgh as constructed of chesnut;" and in a note, "It is remarkable that the same belief of the use of chesnut wood in ancient buildings also prevailed in France. Buffon, however, and afterwards Daubenton, shewed that the timber taken for that of the chesnut was in fact that of *quercus sessiliflora*. The examination, however, and the repeated experiments of late years which have been made upon this wood, have satisfactorily proved that, in all such instances, the timber of the oak, and chiefly of the sessile fruited kind, have been mistaken for chesnut; and this fact, in a great measure, does away with any argument that might otherwise have been adduced in favour of the chesnut's indigenous origin, had the application of its timber in reality been as extensive as these ancient buildings seemed to indicate. It is also more in accordance with what we collect from the *earliest* of our arboricultural writers, viz.—that the chesnut in their time was by no means of common occurrence or widely distributed." "The fact is, as Buffon first observed, the wood of the oak, more particularly that of the sessile fruited variety, assumes in course of time a near resemblance in colour to that of the chesnut in its best condition, or when young and untainted at heart; and as few chesnuts could have acquired the scantling frequently observed in the timbers of these ancient buildings at the age dialing or decay almost invariably commences, this in itself furnishes a strong argument against the use of chesnut timbers and beams by our ancestors, inasmuch as the trees must have become unfit for the purpose long before they had attained the necessary dimensions." "In appearance and colour, the wood bears a resemblance to that of the

oak, but may always be distinguished by its want of the large laminae (flash) or transverse fibres which are seen in the oak, particularly when cut perpendicularly on the outside, in the plane of those laminae." "For gate and other posts, railing, spars for building, piles, and various other purposes not requiring wood of large size, it is well adapted, and perhaps as durable as any other timber we possess."

Sir H. Davy,* also says, "It may easily be known by its want of the laminae, as also from the pores in the alburnum of the oak being much larger and more thickly set than those in the chestnut, which cannot be distinctly seen without the aid of glasses."

The difference between the woods of the two oaks commonly seen in England, is that the grain of the wood of *quercus sessiliflora* is generally less varied and of a more uniform and deeper colour than that of *quercus pedunculata*, and with less of that laminated appearance which is called the *flash* or silver grain. The trees are said to be known by the *sessiliflora* having the acorn stalks *short* or seated, with the leaves *long*; while the *pedunculata* is the reverse, having the acorn stalks *long* and the leaves *short*. The acorns of the former grow in clusters of two or three close to the stem of the branch; those of the latter grow singly or seldom two on the same footstalk. The *quercus pedunculata*, or *robur*, as it is more generally called, is the true old English oak, the *sessiliflora* being supposed to have been introduced some two or three ages ago, from the continent. There appears to be much diversity of opinion among botanists and planters on the value of the timbers of these two oaks, to the same extent at least as that already shown to have existed on the use of chestnut; and some authors deny the botanical difference of the trees.

I have much gratification in being able to exhibit specimens of each of these species of oak, and also others of chestnut, by the well known liberality of Dr. Lindley, who at once responded to my application for the loan of them for this evening's exhibition: my remarks will thereby be rendered more intelligible on your personal comparison of the several woods.

Chestnut timber has been often urged as a material for ship-building. One apparently qualified writer, Monteath, says,† "Notwithstanding the excellent quality of the Spanish chestnut timber, which is equal to the oak in ship building, and also for any machinery, yet it has not been generally used; but this tree should be both more planted and more used as timber." Also, "Spanish chestnut is used by cabinet-makers for boxing, at 2s. 6d. per foot, though it is of much more value when suitable for ship-building, as it is often used for that purpose." While Matthewa, in a much commended work on Naval Timber (1831), says, "There is one circumstance connected with this timber in this country, at least in Scotland, which must prevent its general use in ship-plank, and be of material injury to it for ship timbers; this is, that few trees of it of size are found without the timber being shaky or split, some to such a degree that the annual rings or concentric growths have separated from each other." "From the use of the Spanish chestnut in the Spanish Navy, both in planking and timbering, and from the roofing beams and ornamental work of Westminster Hall being also of this wood, we should suppose it was not so liable to this defect of rents in the timber in milder climates. It is, we should think, as capable of supporting weight, when stretched as a beam, as the oak. Having much less proportion of sap wood, and from the matured wood containing much less sap or moisture, we should suppose it not so liable to dry-rot, or that more simple means, or a shorter period, would suffice for seasoning it, so as to be proof against this evil." According to Belidor, chestnut soon rots when built in a wall, therefore the ends of joists of this wood should have a free space left around them.‡

In the 10th volume of the Transactions of the Society of Arts,|| the writer urges that "for most purposes except shipbuilding, chestnut will be found equal to oak; and in buildings and out-door

* Agricultural Chemistry, p. 222, 4th edition.

† Tredgold's Carpentry, p. 225.

‡ The Forester's Guide, 1824, p. 194.

|| 1792, p. 37.

work, much superior. In 1726 a piece 13 in. square was used as a hanging-post to a gate, and being found, after fifty-two years use, perfectly sound, was again put down for a clapping-post. In 1743 a large barn was built with some of this timber and is now sound in every part, as well as several chestnut posts and rails, after standing thirty or forty years. And a fencing made of oak and chestnut posts, being removed after twenty years standing, the chestnut was found perfect, while the oak posts could not be used again without a spur to support them. The writer accounts for Evelyn's assertion of the decaying nature of chestnut, by stating that it is the case with old chestnut, that has been suffered to stand beyond the time of its attaining its full growth; it is then the worst of all timber, being more brittle and more apt to crack and fly into splinters than any other; but he adds, I have never known this to be the case with young chestnut. If it be cut when it squares only six inches, it will be as durable as an oak of six times its size and age."

My attention has been directed to many other works describing chestnut, but the majority of them are mere repetitions of the views or mistakes of earlier writers, rendering it quite unnecessary to detain you while quoting them.

From all these varied statements then, we may conclude, that the absence of spiders is not sufficient evidence to determine whether the woodwork under inspection is oak or chestnut, or even whether it be either of those timbers.

That when the outside of timber presents that rotten dusty appearance generally seen in old roofs, it will be next to impossible to decide whether it be of oak or not; and that the only way to discover the fact will be by obtaining a well smoothed portion of it, or if possible, a sight of the ends of some of the pieces, from which to ascertain whether there are any laminae—the absence of them being the distinguishing mark of chestnut.

That taking into consideration all the evidence collected, there is no proof of chestnut timber having been used in Mediæval buildings; therefore all results which have been promulgated upon the efficiency of a so-called chestnut timber must be valueless as regards that timber.

That certain experiments would appear to decide that small scantlings of chestnut are quite equal, if not superior, to oak for several purposes, "but the wood of old trees is unfit for any situation where an uncertain load is to be borne, as it is brittle." "It bends more than oak at the time of fracture, and therefore is tougher. Its toughness seems to permit it to yield insensibly till every particle exerts its utmost force, and then it gives way at once, more in the manner of metals than in that of woods."* This well known circumstance alone, should have raised a doubt in the minds of some of our instructors, before they affirmed so strongly that chestnut timber had been largely used in our Mediæval buildings.

The lateness of the hour prevented any lengthened discussion on the subject of Mr. Papworth's paper.

THE CHAIRMAN mentioned that iron would cause a stain in oak, but would not affect chestnut.

MR. C. H. SMITH, H.M., recommended the test afforded by steeping oak shavings in a solution of ferrocyanide of potassium, which would produce an ink-like mixture; and Mr. JENNINGS, Fellow, stated that self-sown chestnut trees are not met with in this country; the tree being cultivated in plantations, and affording a serviceable timber for out-door purposes.

Thanks were voted to Mr. Wyatt Papworth, for his paper, and to Dr. Lindley, for the loan of numerous specimens to illustrate it.

Mr. McKinell's mode of Ventilation having been explained, with the assistance of a large model, by Dr. AITKEN, the Meeting was adjourned to the commencement of November.

* Treutgoldt, 227; and Evelyn.

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